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EYE STRAIN IN ITS RELATION TO THE VERTICAL CENTRATION OF LENSES.

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IN a considerable class of eye cases, notwithstanding the most careful correction of the patient's ametropia under a mydriatic, his asthenopia still persists. Such a patient commonly undergoes a tenotomy, wears prisms, or goes through a course of muscular prismatic exercise, as the particular belief of his oculist dictates.

It seems pertinent to inquire in this connection whether such methods of treatment are always necessary, or whether the persistent asthenopia may not, in many of these cases, depend upon some unrecognized source of strain present in the correcting lenses themselves.

It is somewhat remarkable that in the literature of refraction there seems to be no adequate recognition of the important part which the centring of lenses plays in relation to vertical strain. Most works on this subject contain warnings as to the dangers of lateral decentration, but the subject of vertical centration receives comparatively little attention. While it is true that De Schweinitz (and possibly others) recommends that the centres of reading-glasses be lowered 5 *mm*, glasses for constant wear are centred for the far point without due weight being given to the fact that the patient *reads, normally, through the lower part of his glasses*, usually at a point about 10 *mm* below their centres, and that only by holding the print far upward or by bending the head downward in an extremely awkward way can the reading-line of vision be made to pass through the optical centres of such glasses. It is also true that, even if it were possible to maintain these awkward positions, they cause an increased

accommodative effort (as pointed out, I believe, by Dr. Duane), since the position of least accommodative effort corresponds to the lower visual plane. As glasses for constant wear are usually arranged, then, there is virtually an equal decentration of both lenses above the reading-point.

In an investigation as to the optical effect of equally decentred lenses, it is evident that three refractive errors may result:

(1) An astigmatic error resulting from the oblique course of the visual rays through the periphery of the lens. This may be combined with

(2) A prismatic error equal in both eyes; or (and most important):

(3) In unlike lenses, an unequal prismatic error.

In considering the effect of these different refractive errors at the reading-point, it is difficult to say just what is the degree of relationship of the astigmatic error to the production of eye strain, as it is always combined with at least one of the forms of prismatic error. It seems probable, however, that, in the case of strong lenses, it may produce asthenopic symptoms, since in cases under my observation blurring and eye strain present when only one eye was used have disappeared on lowering the optical centre of the correcting lens to the reading-point. In practice it is true, however, that many of these patients rid themselves of their reading astigmatic error by tilting their lenses.

The equal prismatic error rarely gives great discomfort. Still, with strong minus lenses, equivalent at the near point to prisms base down, there is sometimes discomfort. I have met with patients who were unable to tolerate prisms of even one degree base downward, while prisms of much greater strength were well borne when reversed.

The greatest percentage of eye strain is of course shown in those cases in which there is an unequal prismatic effect at the near point. The number of such cases is comparatively great, since such a prismatic error occurs at the reading-point (in greater or less degree) in all cases of unequal refraction corrected by unlike lenses as usually centred (with the exception of astigmatic lenses, at or near the vertical axis).

From the table given by Dr. Maddox it is easy to compute the strength of the unequalized prism in any given case, depending as it does upon the difference in strength of the lenses worn and upon the amount of decentration. If, for example, the reading-point is 10 *mm* below the optical centre of the lenses, and their difference in strength is one diopter, an unopposed vertical prism of about $\frac{1}{2}^{\circ}$ results at the near point. It is interesting to note that in this class of cases nearly all patients respond to the tests for vertical insufficiencies, and in such a manner as to suggest a causal relationship between their muscular imbalance and the constant prismatic strain to which they are exposed in reading. The weak muscle in such cases is usually found to be that opposed to the stronger prism, *i.e.*, the one toward which the prism apex points. It would require an analysis of a large number of these cases examined for vertical deviations, both before and after the long-continued use of ordinary correcting lenses, to establish any absolute law of causation; moreover, its deductions would be liable to vitiation by the presence of an *anatomically* stronger vertical muscle, yet such a relationship is sufficiently common to lead often in practice to the more or less perfect correction of a reading *prism-imbalance* by prisms prescribed for the correction of a distant *muscular imbalance* only.

I have reported such a case in another part of this paper, also a very instructive case in which a patient's manifest orthophoria changed while under my observation under the use of a reading-prism to a manifest hyperphoria exactly corresponding in degree and direction to the prism used.

It is now necessary to consider the various methods by which these refractive errors at the reading-point may be corrected. In common practice they are usually corrected either by a vertical prism or by tenotomies, and if the vertical muscular imbalance exactly corresponds, as pointed out above, in kind and degree to the unequal prismatic error at the reading-point, prisms often give good results. This fact perhaps accounts for the many satisfactory results seen in prescribing vertical prisms, but such perfect correspondence must be rare.

If the problem is attacked from the side of the lenses themselves, it is of course possible to give perfect reading prism-balance in every case by neutralizing the unequalized vertical prism by an adverse prism of equal strength. Such a correction, however, does not always give perfect relief, since with strong lenses an astigmatic and equal prismatic error remains to cause discomfort.

A still less satisfactory method of treatment, yet a common one, is by a tenotomy of the *functionally* strong muscle. This often gives temporary relief, since an artificial muscular imbalance is produced which tends to counterbalance the prism at the near point. Unfortunately the good effect of this measure is usually of short duration, since the reading-prism is not itself affected, and continues as a source of muscular strain.

The most effective method of correction in these cases is the decentring downward of both lenses to the reading-point, thus eliminating both the astigmatic and prismatic errors. These errors, it is true, are transferred *reversed* to distant vision, but they are here partially overcome by an altered position of the head, and give little trouble. It might be urged that it is the reversed position of the prism, tending, as it does, to correct the muscular imbalance usually shown in these cases (as pointed out above), which gives the relief experienced, were it not for the fact that such patients are even *more* comfortable in bifocals, containing the same correction in both segments, and having, of course, separate centres for distance and reading, than in their decentred lenses.

Theoretically such bifocals are the ideal correction for this class of cases, as they eliminate the astigmatic and also all vertical prismatic errors; practically, however, they are usually unnecessary, the patients doing sufficiently well in their decentred glasses.

ILLUSTRATIVE CASES.

CASE I.—**Astigmatic and equal prismatic error at the reading-point.**

Mrs. A. B., aged twenty-six, complained of blurring of print and discomfort in reading. Was wearing — 2.c ax 180° each

eye. She showed vertical orthophoria, and exophoria 1°. Under homatropine, refraction remained the same, viz., — 2.c ax 180° each eye.

The lenses which she had been wearing proved to be equivalent at the near point to prisms of 1° base down. They also considerably increased the astigmatic correction. I gave the same lenses decentred downward to the reading-point. She has since reported entire comfort.

CASE 2.—**Unequal prismatic error.**

Mr. C. D., aged twenty-seven. Patient complained of great discomfort in reading, but of none in distant vision. His refraction had been corrected by two different oculists within a year, and he was then wearing O D — .75 + 1.25c ax 90° ; O S + 1.c ax 90° ⊃ ¾° prism base up.

The patient had greater discomfort in reading since visiting the last oculist, who added the prism to his correction. An analysis of his lenses showed that they were equivalent to a prism of about ½ degree, base down over right eye, at the reading-point, while over the left eye was the added prism of ¾ of a degree, base up. The whole unequal prismatic correction at the near point was then 1¼ degrees.

Muscle tests showed right hyperphoria ½° lateral orthophoria. His refraction remained the same under homatropine, viz.,

O D — .75 ⊃ + 1.25c ax 90°; O S + 1.c ax 90°

I discontinued in this case the prism over the left eye and decentred the right lens (which alone produced any prismatic effect) downward to the reading-point. The results were most gratifying. The patient has since been absolutely comfortable both for near and far work. The muscle tests, as I found them, were in this case such as to lead one to increase the unequal prism at the near point, as had been done by the previous oculist. Possibly this anomalous muscular condition was due to the continued use of the prism over the left eye, or it may have been originally present. At any rate the case is of interest as showing the good effect of prism-balance at the near point, even when the muscle tests are adverse.

CASE 3.—**Unequal prismatic error, combined with an astigmatic and equal prismatic error at the reading-point.**

Miss E. F., aged twenty, a schoolgirl. This patient's refraction of O D — 1.75, O S — 4. was corrected by an oculist, who

told her at the time that she had perfect muscle-balance. She wore her correction for some time with comfort, and then returned complaining of headache and great discomfort in reading. She then manifested a right hyperphoria, and a tenotomy was done on the right superior rectus, giving her great temporary relief. About six months afterward her headache and asthenopia reappeared, and it was impossible for her to read without great discomfort. She now consulted another oculist, who gave her considerable relief by prescribing vertical prisms. When she came under my care she still complained of some discomfort in near work. I was greatly interested in this case to find that the prism which she was wearing almost exactly neutralized her unequal lens prism at the near point, but an equal prismatic effect of about 1°, base down, with a considerable astigmatic error, still remained. I had both lenses decentred down to the near point, and the patient now reports herself to me (after a year) as having been perfectly comfortable since.

Case 4.—This case is of interest as showing the slight benefit received from repeated tenotomies and the great relief after decentring the lenses.

Mr. H. I., aged twenty-seven, student. Patient had compound myopic astigmatism of right eye ; mixed astigmatism, left. He suffered constantly from asthenopia in reading, even after his refraction had been corrected. He now consulted a second oculist, who found left hyperphoria and tenotomized the right inferior rectus. His asthenopia still persisting, he sought another oculist, who found more left hyperphoria and also lateral insufficiencies. He was again thoroughly tenotomized until the tests showed a practical orthophoria, but with little relief to his asthenopia. He came to me complaining that he was unable to read more than a few minutes at a time without the print doubling and blurring. His refraction was as follows : O D — .50 — 2.75c ax 180°; O S + .50 — 2c ax 10°. Vertical orthophoria, and exophoria 2°.

The unequal prism imposed by these lenses at the reading-point was about 1°, base downward, over the right eye. He also had a comparatively large astigmatic and equal prismatic error, to which he was very sensitive, as shown by the fact that a neutralization of his unequal prismatic error did not give him full relief.

He experienced, however, almost perfect relief on decentring both lenses to the reading-point, and was very comfortable for

several months afterward, but as he found that a change of occupation, requiring a great deal of near work, caused a slight return of his asthenopic symptoms, and, as he had deficient accommodative power, I gave him bifocals, with weak plus glasses and converging prisms in the lower segments. Under this correction he has since been very comfortable.

CASE 5.—The following case shows in an interesting manner the transition from orthophoria to heterophoria under a reading prismatic strain.

Miss Z., aged seventeen, a working-girl, for a number of years has had great discomfort in reading, but has never worn glasses. V: O D $\frac{20}{40}$; O S $\frac{20}{60}$; orthophoria. Under homatropine $\frac{20}{200}$ w O D + 1. + 2.c ax 90°; O S + 4.50c ax 90°.

Thinking it of interest to discover whether any heterophoria or discomfort would result from the comparatively small degree of unequal prismatic strain (equivalent to between $\frac{1}{2}$ and $\frac{3}{4}$ of a degree) produced at the reading-point by these lenses, I did not have them decentred. I was somewhat surprised by her return a few weeks later, complaining of discomfort, confined entirely to reading and the near use of her eyes. She now disclosed $\frac{3}{4}°$ of right hyperphoria.

I decentred the right lens to the reading-point and she at once experienced entire relief.

It would seem from a study of these cases that the ordinary method of lens centration tends to give rise to a class of pseudo-insufficiencies which complicate the already difficult problem of muscle-balance. The whole matter of the relation of the muscles to vertical prism-imbalance at the near point deserves still more study; and it is my hope that by calling attention to the possibility of such pseudo-insufficiencies, further work may bring out much which may prove of advantage to students of the ocular muscles.

SOME AIDS IN OPHTHALMIC TEACHING.

By Prof. F. DIMMER, Innsbruck.

Translated by Dr. Matthias Lanckton Foster, New York.

(With six figures in the text.)

I HAVE tried to arrange the instruction in my clinic so that all hearers could follow the demonstration of pictures, anatomical preparations, etc., for there can be no doubt that thus the purpose of the teaching is to be best accomplished. If pictures or preparations are handed about during the lecture, the attention of the student is of necessity divided: either the object circulating for observation will not be properly considered, or a part of the lecture will be lost. If the material referred to is demonstrated to the students in groups, as is necessary with regard to certain objects, the demonstration is to a small number at the expense of an enormous loss of time, not to mention that during this time the larger number of students are unoccupied. The words of the speaker should produce a steady, active connection between the objects demonstrated and the minds of the hearers, and this is possible only when the teacher can show during the lecture objects illustrative of his words visible at the same time to all. I present here no new discoveries, and it is possible that in one or another clinic similar arrangements exist, but as I know that in the majority of eye clinics the teaching is not conducted according to the above-mentioned principles, I have determined to describe the apparatus used in my clinic.

1. A SKIOPTIKON.

It is more necessary than in any other branch of medicine

to exhibit microscopical preparations to the students in ophthalmology. Both the physician and the surgeon can refer in their lectures to books and demonstrations of pathological anatomy, but the ophthalmologist cannot do this, because in the works of pathological anatomists the special pathological anatomy of the eye is treated of, either not at all, or at least very incompletely, while a knowledge of it is necessary for understanding the process of disease, for making a diagnosis, and for correctly performing operations on the eye.

Microscopical preparations may be demonstrated either with the common microscope as an adjunct, or with the demonstration-microscope as an accompaniment to the lecture, but neither of these methods can compare with the projection of such on the wall by means of the skioptikon, so that the teacher can indicate with a rod each portion separately to his hearers. The skioptikon can also easily be used for the projection of schematic drawings, pictures of cases of disease, and ophthalmoscopic plates.

The commonest form of skioptikon is fitted up with electric light, and projects on the wall objects in their natural colors, but the cost of such an instrument is so great as to form a serious obstacle to its introduction into the eye clinic, at least here in Austria. I have therefore endeavored to construct the cheapest possible skioptikon which will suffice for the demonstration of the pathological histology needed by the teacher of ophthalmology for the purpose of the clinic, and for this purpose a low power of enlargement is most useful to illustrate the topographical changes in the various diseases of the eye; the higher powers of enlargements are less frequently of service.

Instead of the electric light the calcium light of Drummond or the zircon light may be used, but the first, the handling of which requires care, is inferior to the electric light, and I am convinced that the zircon light, the management of which is rather difficult and costly, is no more effective than Auer's gaslight,[1] which I have adopted. The skioptikon as constructed by me (Fig. 1) consists of a wooden

[1] Similar to our Welsbach light.—Transl.

box, lined with asbestos, 34 *cm* long, 30 *cm* broad, and 40 *cm* high, with a chimney of sheet-iron. Within the box

FIG. 1.

an Auer's burner is so fastened as to be movable forward and backward from the centre, and also, by means of a screw,

upward and downward. On the posterior wall of the box is a metallic concave mirror. The interior is reached through two lateral, barred doors.

On the anterior wall are lenses, 10 *cm* in diameter (see Fig. 2, a, which represents a horizontal section of the skioptikon), in front of which on the anterior surface of the box are horizontal, grooved cleats to permit a board 45 *cm* long to slide in front of the lenses. In each half of this board is an opening 10 *cm* in diameter. Before one a skioptikon objective is placed (c), behind which is a space for the introduction of glass plates (d); before the other (e) is a tin tube 14 *cm* long, which becomes narrower as it extends forward and presents in its smaller end an opening 30 *mm* in diameter, with a diaphragm (f) capable of reducing its size to any degree required between 30 and 5 *mm*. In front of this is a bracket

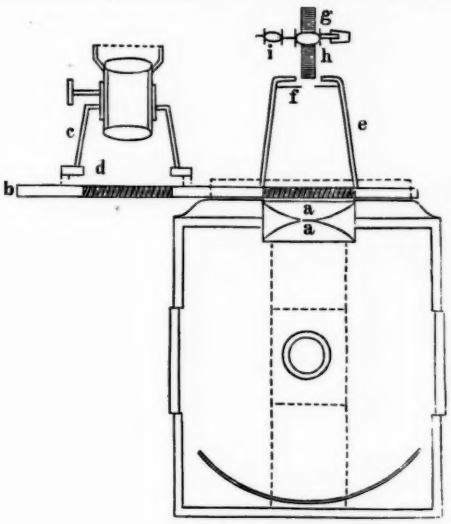

FIG. 2.

for the insertion of microscopical preparations. From the lower margin of the tube projects a toothed bar (g), on which a perpendicular metal plate is moved by a rack and pinion. This has two openings, 22 and 28 *mm* in diameter, in which two magnifying lenses (h and i) can be inserted. By a single

motion of the metal plate about an excentric fixed point, first one, then the other magnifying lens can be brought into use. I have used Edinger's apparatus for projection and delineation, and find that with the large opening they give very luminous pictures, although not quite free from spherical aberration.

The cost of this skioptikon, made according to my directions by C. Reichert in Vienna, VIII., Bennogasse 22, is 216 marks. It can be mounted on an ordinary photographic stand (see Fig. 1) at an additional cost of 43 marks.

The skioptikon is placed at a distance of rather more than two metres from a white paper stretched over a frame one and a half metres square, and then with the weaker lens sections of the entire globe, magnified to a metre in diameter, can be projected upon it. The intensity of the illumination is sufficient to permit the recognition of details at the distance of seven metres, although their outlines are not quite sharply defined, a fact which, in my opinion, is of no consequence, because the pictures are intended to be viewed only from a distance, and also because the grosser proportions alone should be shown in this manner. Thus can be demonstrated all of the topographical relations of the eye for which the weakest powers of the microscope would be used, as well as longitudinal sections of the optic nerve enlarged sufficiently to show the outlines of a glaucomatous or of a physiological excavation, or of a choked disc, the diameter of the papilla being about ten or eleven centimetres. Of late I have seldom used the stronger magnifying lens, because it is more convenient to have the skioptikon stand always in the same place, and when this lens is used the delineations on the wall will be indistinct unless the instrument is moved; but it is of value in certain cases.

For all conditions, whether normal or pathological, a sufficient enlargement of which cannot be obtained by means of these magnifying lenses, as where the visibility of cells or of collections of cells is in question, positive photo-transparencies from microscopic preparations may be employed, inserted behind the skioptikon objective in wooden frames 8 *cm* square. The change from the projection of

microscopic preparations to that of these photo-transparencies is accomplished very quickly by simply shoving the above-mentioned board (Fig. 2, b), so that, if needed, microscopic preparations and photographic transparencies may be exhibited in turn. (In Fig. 2 the board is placed as if for the employment of microscopic preparations.) Beside these photo-transparencies of microscopic preparations I have a large number of others of the normal and pathological anatomy and histology of the eye and of the nervous system, schematic drawings, etc. When the instrument is situated two metres from the wall the size of the reproductions of these pictures is from 100 to 115 *cm.*

It is hardly necessary to say that in my lecture-room are a number of large charts hanging on the wall, to which reference is often made to illustrate the most important relations of the eye. They are seven in number, 115 *cm* long by 75 *cm* broad, with lettering large enough to be easily read at a distance of seven or eight metres. They represent: 1, the normal meridional section of the eye; 2, the distribution of the blood-vessels in the eye according to Leber; 3, a vertical section of the upper lid; 4, a longitudinal section of the optic nerve, and also the ophthalmoscopic picture of the papilla; 5, an antero-posterior section through the orbit and the globe; 6, the anatomy of the orbit in three pictures—(*a*) the muscles, (*b*) the vessels, (*c*) the nerves; 7, a horizontal section through the globe and orbit. But to make all the pictures which are needed of like size to hang on the wall would occasion great expense, while they could not all be hung at once on the walls of the lecture-room, but would have to be kept in cases and brought out when desired. Positive photo-transparencies, on the contrary, cost very little and serve the purpose quite as well.

To make those photo-transparencies I use the following simple apparatus, which, adjusted much after the manner of the ordinary microphotographic apparatus, has the advantage that it can be used for the taking of microscopic preparations and also, with certain modifications, of pictures.

A vertical board 30 *cm* high, with a square aperture in its middle 54 *cm* across, is fastened 94 *cm* from the

end of a horizontal board 178 *cm* long (Fig. 3). Behind this vertical board the bellows of a camera, which when fully extended measures 85 *cm* in length, is placed. In the square aperture is inserted a little board carrying an objective and bound with a short tube of black cloth. The other portion of the horizontal board has a cleft which extends almost its entire length, wherein may be placed: 1, a board to which is to be screwed the stand of a microscope; 2, an Auer's gaslight burner; 3, a vertical board 31 *cm* high, 24 *cm* broad, secured to a small horizontal board.

To photograph a microscopic preparation, the stand of the microscope thus placed is secured near the vertical fixed board. Its tube, which must be blackened on its inner surface, or be lined with a tube of velvet, in order to avoid disturbing reflexes, is then inserted into the little black cloth tube attached to the little objective board and then wrapped about if daylight be present. Between the gas-burner and the microscope an illuminating lens of 10 *cm* focal distance is placed. A green glass is then inserted behind the diaphragm and Hartnack's objective, either No. 2 or No. 4, may be used. If the former is chosen, Abbe's apparatus is not used and the aperture in the diaphragm is made 2 or 3 *mm* in diameter; while if the latter is chosen the Abbe is used, its lens placed about 5 *mm* from the preparation, and the aperture in the diaphragm is still further reduced in size. The time of exposure in either case is the same. I have always used the orthochromatic eosin plates, which last well.

When it is desired to photograph a picture, the microscope, illuminating lens, and gas-burner are removed, and in place of the little objective board with the black cloth tube another little board of the same size carrying a photographic objective is inserted in the upright board (Fig. 4). I use the anastigmatic objective of Zeiss Ser. II. a, No. 2. The object to be photographed is now attached to the movable upright board. Such plates and books as are of sufficient size, about 24 *cm* broad, can be fastened directly to the board by means of binding-screws, while for smaller ones I have used the following means: A drawing-board

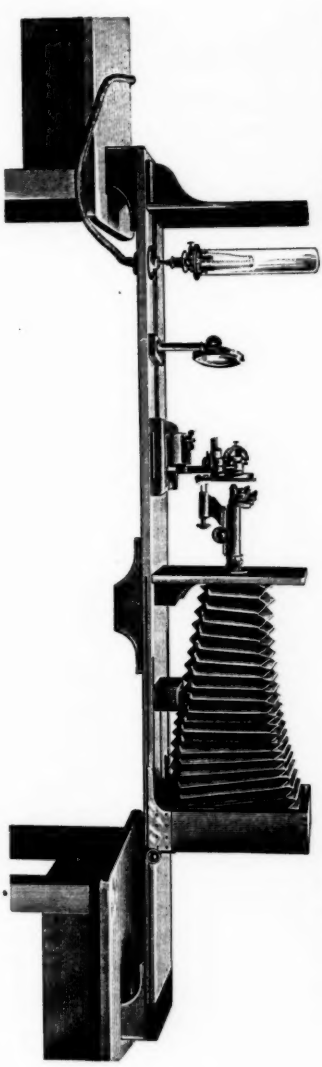

Fig. 3.

Fig. 4.

40 *cm* by 30 *cm* is secured to the upright movable board by means of a screw and nut. A frame of four bars is attached to the drawing-board by four binding-screws which pierce their points of intersection, and by this frame the book is clamped firmly in place, as may be seen in Fig. 4. As the drawing-board is bound fast to the movable vertical board, the object to be photographed can be moved along the cleft in the horizontal board as desired, and the objective placed at a greater or less distance from it so that enlargements or reductions can be satisfactorily obtained. Thus pictures of the size of those in Becker's atlas of the pathological anatomy of the eye can be reduced to the size of 8 *cm* by 8 *cm*, while by extending the bellows of the camera small objects may be enlarged to the same size.

In order to use the apparatus for other purposes, such as making enlargements and photographing patients, the plate-holders are changed so that plates 13 by 26 *cm* can be used as well as those 8 by 8 *cm*. If it is desired to make photographs of only the smaller size, this part of the apparatus may be made correspondingly smaller.

The apparatus, without the Auer's light or illuminating lens, may be obtained from R. Goldmann, manufacturer of photographic apparatus, Vienna, IV., Victorgasse 14, for 46 marks, and can easily be adapted to any microscope stand.

The negative is almost always strengthened with a solution of corrosive sublimate and the photo-transparency prepared by laying the negative on the chlor.-brom.-diapositive plate of Schattera and exposing it for from 15 to 25 seconds in the dark room to the light of a 16-candle-power light placed at the distance of half a metre. It is then developed and covered with a thin solution of xylol to neutralize any defects in the plates. Finally, over the photo-transparency is placed a cover-glass, separated from it by the interposition of strips of paper, and then the margins of both plates are bound with paper pasted about them. Reckoning the expense of the chemicals, which is very slight, a completed photo-transparency costs 15 kreutzer, or 6 cents, while a large chart to hang on the wall and serve the same purpose would cost from thirty to fifty times as much.

For the representation of the fundus of the eye Malakoff has make ophthalmic pictures on glass, not for the purpose of projection, but to give them a greater degree of transparency and natural appearance; but as the production of such pictures is associated with great labor and expense, I have sought to find a simpler means. I first cut up a Jæger's ophthalmoscopic hand atlas, make the separate pictures transparent, and project them on the wall, the same as the microscopic preparations. To make them transparent they are first laid in 95% alcohol, then in carbolxylol (acidi carbolici in alcoholis liquefacti 100 gr., xyloli 300 gr.); a rather syrupy solution of Canada balsam is then dropped on a glass plate in a skioptikon frame, 8 by 8 *cm*, and when the picture has become transparent it is placed upon this and the air bubbles are carefully removed by pressure. More Canada balsam is poured over the back of the picture until it forms a tolerably thick layer, and the plate is then laid in a horizontal position in a warm place until the balsam is perfectly hard. Short strips of thick paper are then glued to the four borders of the plate, and to these is glued a cover-glass of the same size as the plate, with great care that it does not come in contact anywhere with the layer of Canada balsam, because the least unevenness in this layer would cause reflection of the light and injure the luminosity at this place. Finally the margins are bound with paper as before. I have thus prepared and used all of the plates in Jæger's, and many in Haab's atlas.

As these pictures were printed with opaque colors some of them are naturally lost in the process of rendering the paper transparent, and in the projection most of the colors appear too dark, while many fail to appear at all, but the delineation remains perfect, so as to permit the easy demonstration of every detail. The fact that the original colors in the picture are changed or lost seems to me to be of little importance, for the object of their exhibition is not to take the place of ophthalmoscopic examinations, but only to serve as aids in the lectures. The true colors the student must learn by direct examination, for the best atlas cannot reproduce the same shade and transparency that is seen in

nature. In addition to this I have taken the precaution to have in the lecture-room all the plates from the atlases of Jæger, Liebreich, and Haab, framed and with the correct diagnosis written beneath, so that the students can study them before or after the lecture, or during the afternoon. After the demonstration of an ophthalmoscopic picture projected on the wall, I also invariably call the attention of the students to the plates hanging on the wall and recommend study of these additionally.

Some plates taken from other atlases which were too large to be used in this manner, or were printed on paper unsuitable to be made transparent, as those in Wecker and Masselon's, and Gowers's atlases, together with a part of the plates in Liebreich's atlas, were photographed and photo-transparencies prepared and projected.

At present, June, 1896, there are in use in my clinic 143 microscopic preparations and 361 plates suitable for projection, a number which naturally is being continually increased, divided as follows:

1. Microscopic preparations, 143.
2. Photo-transparencies from microscopic preparations, 105.
3. Photo-transparencies from plates, including preparations, schematic drawings, etc., 45.
4. Plates of the fundus of the eye: *a*, taken from ophthalmoscopic atlases and rendered transparent, 164; *b*, photo-transparencies from ophthalmoscopic plates, 47.

The gas is always lighted in the skioptikon before the lecture, as the newer pattern of Auer's burner is provided with a little adjunct whereby, when the cock is properly turned, the gas is allowed to burn in a minute flame, so that when it is desired to use the apparatus the lecture-room is quickly darkened by closing the shutters, the gas-cock is turned, and everything is ready. I set apart no special hours for the demonstrations, but use them in connection with the lecture or following the exhibition of patients.

Prof. Czermak of Prague has used a skioptikon like this for some time and is much pleased with it.

2. AN APPARATUS TO DEMONSTRATE THE COURSE OF THE RAYS OF LIGHT THROUGH LENSES AND IN THE EYE.

I have made two appliances to be attached to the skioptikon for the purpose of demonstrating the course of the rays of light, utilizing the well-known method of rendering them visible by means of smoke or of fluorescent liquids.

First, the board which carries the objective for the projection of transparencies and the magnifying lenses is removed, and its place supplied by a board with a round hole in its middle 55 *mm* in diameter, in which is a metal plate with a pear-shaped opening 15 *mm* long by 10 *mm* broad, covered with a piece of tissue-paper made transparent by treatment with Canada balsam dissolved in xylol. In front of this is placed a box 60 *cm* long, 12 *cm* broad and high (see Fig. 5), the lateral as well as the anterior and posterior walls of which are of glass. The latter also open as doors. A cleft runs longitudinally for almost the entire length of the upper wall of the box, while the floor is pierced in two places for the insertion of two tubes with mouthpieces. Just in front of the skioptikon the box is supported by a foot of the proper height, while its other end rests on a block of wood placed on a wooden box which stands in front of the skioptikon on a table of corresponding height (Fig. 5).

Two square little boards, somewhat smaller than the section of the box, are placed within, where they are held in position in the cleft in the upper wall of the box by means of clamps in such a manner that they can easily be moved backward and forward, as shown in section in Fig. 6, and may be withdrawn by turning them 90 degrees, until parallel to the cleft, and lifting them out. In the middle of each is a round hole 30 *mm* in diameter, beside which are clamps to hold lenses.

To demonstrate the passage of light through convex lenses, a 12 D lens is placed in the clamps of each of the two little boards above mentioned, a screen is made by covering a little frame with tissue-paper, all three are introduced into the box through the cleft in its top, and the box is then filled with cigarette smoke blown in through the rubber tubes.

A cloth folded several times may be laid over the top of the box to prevent the rapid escape of the smoke, but this is never really necessary, because a very small quantity of smoke will suffice to make the rays visible.

FIG. 6.

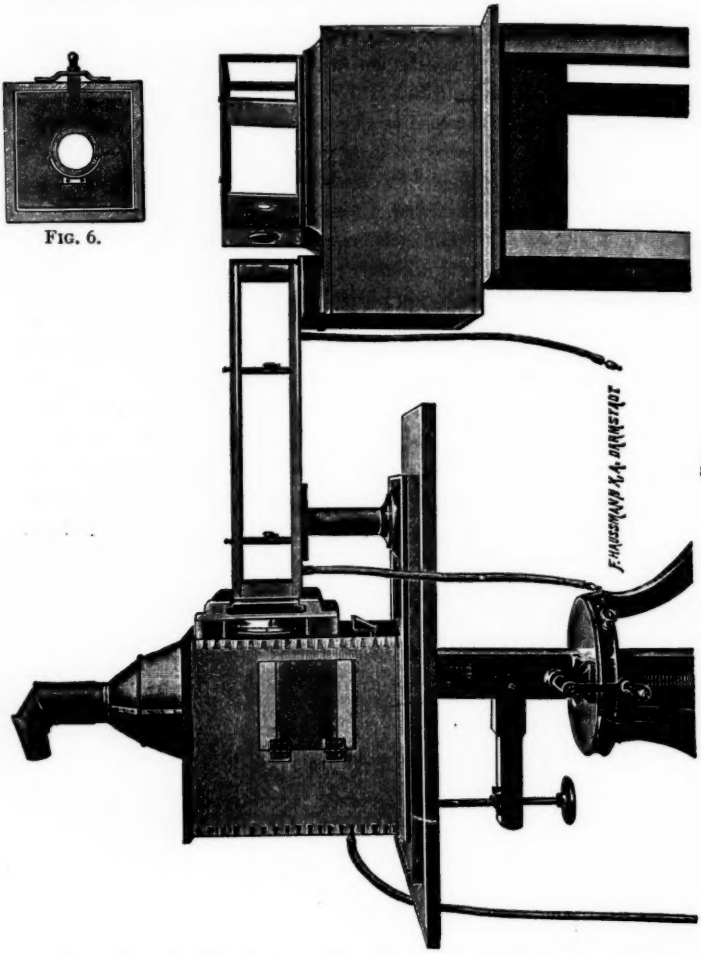

FIG. 5.

To show the manner in which parallel rays are focussed, a diaphragm of black paper with a pear-shaped opening is at-

tached to the lens nearest the skioptikon before it is put in position, and the lens is then placed at its focal distance from the opening in the skioptikon, which permits the exit of the rays of light. The parallel rays which emerge from this lens are united by the second into a focus on the screen, where the inverted image of the aperture in the diaphragm demonstrates the reduction and inversion of images thus formed.

The course of converging rays when refracted by a convex lens is shown by moving the first lens, with the diaphragm still attached to it, away from the skioptikon and bringing the second lens nearer to the first. The refraction of diverging rays which fall upon a convex lens is demonstrated by using only one lens, from which the diaphragm has been removed, upon which the diverging rays from the skioptikon fall.

Refraction through concave lenses may likewise be demonstrated by placing a 12 D concave lens in the second board and throwing upon it parallel rays from a 12 D convex lens in the first.

To the apparatus can now be added a tin box made to resemble the artificial eye of Kuhne, 30 *cm* long, 15 *cm* broad, and 15 *cm* high. At the end externally is a fold of tin in which is placed a glass plate, to which a watch crystal 7 *cm* in diameter and of 14 *cm* radius of curvature, filled with water, is fastened with Canada balsam. Within is a tin plate with a round hole 30 *mm* in diameter, hanging on two wires which rest on the sides of the box. Behind the central opening in this tin screen a 14 D lens is secured by a clamp, so as to represent the crystalline lens. A piece of ground glass, supported in the same way as the just-mentioned tin plate, serves to represent the retina. Fig. 5 shows the entire construction of the skioptikon and of the appliances just described.

After the tin box has been filled with water colored with uranin or fluorescin, so that the passage of the rays of light through the fluorescent water may be visible, axial myopia and hypermetropia may be demonstrated by moving the piece of ground glass which represents the retina backward and

forward, as well as the effect of a backward and forward motion of the lens. When the retina of the artificial eye is so placed that parallel rays which fall on the cornea are focussed on the retina, and then, instead of parallel, divergent rays are allowed to fall on the cornea, a dispersion of the rays on the retina is obtained, when by means of a second convex lens it can be shown how the accommodation focusses them again on the retina. If it is assumed that the point where the rays diverge is the near point of the eye, the convex glass last used represents the amplitude of accommodation of the eye.

The refraction of cylindrical lenses may be shown in the same manner. To do this I have cemented on a second glass plate to be placed on the anterior surface of the model a glass which has a much greater radius of curvature in one meridian than in the other, 14 *cm* in the horizontal, 8 *cm* in the vertical meridian, such as may be found at any glazier's, as they are often used in framing oval pictures, with the space between it and the plate filled with water the same as in the other case. When this is placed before the model instead of the spherical glass, myopic and hypermetropic astigmatism can be demonstrated by moving the plate which represents the retina backward and forward. Behind the 12 D convex lens which renders parallel the rays coming from the skioptikon is placed a piece of black paper in which is a horizontal slit, interchangeable with another with a vertical slit. With these it can be shown that, for example, in an eye which is myopic in the vertical meridian, emmetropic in the horizontal, the vertical line is distinctly formed, while the horizontal appears hazy, and by then passing before the cornea of the model a cylindrical lens the horizontal line may also be made distinct and the astigmatism corrected.

3. A MECHANISM FOR THE DEMONSTRATION OF THE FIELD OF VISION.

A board 80 *cm* square has a diagram of the visual field painted upon it in black oil-colors on a white ground, without indicating the blind spot. Over this surface a slightly roughened glass plate of the same size is clamped, on which

the field for white can be very easily and quickly drawn with black crayon, and the fields for the different colors with the corresponding crayons. The blind spot is marked with black crayon in its proper place, according as the representation is one of the right or of the left eye.

Typical contractions of the field I demonstrate by means of water-color drawings on pieces of waxed paper of the same size as the model, stiffening above and below with strips of paper. One of these is laid in proper position on the model, secured by clamps, and is then ready for exhibition. At present there are thirty different visual fields thus shown in the clinic.

Some cases of contraction of the field in which it is important to present both fields at once, as well as cases of hemianopsia, are drawn on a smaller scale on white paper. Although these are also fastened to the board when exhibited, the board serves them only as a support—the model is not used.

The appliances here described have proved of service to me, and I do not begrudge the expenditure of time and labor devoted to their preparation. I would not be without them while teaching, and I hope my hearers would speak equally highly of them.

Clinical teaching accomplishes its purpose perfectly only when the students learn all worth knowing during the hours of instruction and practice, so that the study of books is secondary and its sole object is to arrange and recapitulate the knowledge obtained in the clinic, because the clinical teacher, confined to the material present, cannot arrange it in logical order, as is done in the text-books; and if any number of teachers who have the desire to model their instruction along similar lines have the attainment of this purpose lightened, and their time and labor spared, this article will have accomplished its entire purpose.

I wish to acknowledge the zealous and effective assistance which I have received from the demonstrators of the clinic, medical students Jul. Schoch and Dovolavilla, in the preparation of the photo-transparencies, glass plates, visual fields, etc.

THE QUESTION AS TO THE PRESENCE OF GANGLION CELLS IN THE IRIS.

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FROM THE LABORATORY OF THE UNIVERSITY EYE CLINIC IN BERLIN.

Translated by Dr. Ward A. Holden.

(*With seven figures on Plates III.–IV. of vol. xxxiv., Germ. ed.*)

THE nervous system of the iris has long been a favorite field for investigation, and from the numerous papers published it would appear that the richness of this sensitive part in nerve elements is truly remarkable. In taking up this subject again, I proposed to determine by means of new methods of investigation whether ganglion cells were really present in the iris or not, and thus clear up a point on which the statements in the literature are very divergent.

There are facts which seem to indicate theoretically that the iris is provided with special local nerve centres which, independently of the central nervous system, may control its musculature; in this way we could explain, for example, how atropine applied locally dilates the pupil after section of the ciliary ganglion (Hensen and Völckers) and after enucleation of the eye (de Ruyter), or how exposure to light contracts the pupil after excision of the iris (Brown-Séquard). This idea of nerve centres in the iris has not, however, been substantiated by anatomical researches, and we know, furthermore, that in this matter each writer has had an individual opinion which has in no case been so well founded as to withstand the attacks of his opponents.

METHODS OF INVESTIGATION.

For demonstrating the nervous system of the iris I chose the eyes of white rabbits, and stained the living tissues by Ehrlich's methylene-blue method and its recent modifications. Young rabbits were killed with ether, the eyes removed immediately, and with a hypodermic syringe a small quantity of a $\frac{1}{20}$ % solution of methylene blue injected into the anterior chamber. From three to five minutes afterwards the eyes were divided by an equatorial section, and the iris was carefully removed, cut into four segments, and spread out on a slide. It was then found that the nerves for the most part were stained blue, while the other tissue of the iris remained uncolored.

The effect could be intensified by injecting the stain into the vitreous fifteen minutes before the animal was killed, or by dropping a 1:3000 solution of methylene blue on the excised iris and heating the preparation for fifteen minutes. The stain was fixed by leaving the preparations from twelve to twenty hours in a saturated aqueous solution of picrate of ammonia, to which some drops of spirits of ammonia had been added; they were then cleared by being left twenty-four hours in equal parts of glycerine and water saturated with picrate of ammonia, and were finally mounted in glycerine. In order to prevent pressure of the cover upon the specimen, a cell was made of thick paper soaked in the picrate of ammonia-glycerine solution. To prevent drying the margins of the cover-glass should be covered with Damar or asphalt.

Microtome sections of the iris can be better stained by Bethe's[1] methylene-blue method, but the results are not so good as when the entire iris is stained.

THE NERVOUS NETWORK OF THE RABBIT'S IRIS.

When a flat preparation of the iris is viewed under a weak objective, the location and course of the nerves can readily be followed (see Fig. 1, Pl. III.).

The ciliary nerves after passing through the ciliary body

[1] *Archiv f. Microscop. Anat.*, xliv., p. 579.

enter the iris in distinct radial bundles (*a*). There they at once bend and run parallel to the ciliary margin, anastomosing freely. They then send a number of thick trunks (*b*) radially toward the pupillary margin, and give off a great quantity of smaller twigs. The larger of these trunks (*b*), after extending through a third or a half of the breadth of the iris, bend in arcs and unite, forming arcades from which, again, radial fibres (*c*) run, and in their turn form arcades. Besides these arcades formed of the larger twigs, there are quantities of finer arcades formed of smaller twigs, which are numerous about the pupillary margin (*d*).

All these bundles send off, one after another, finer bundles which eventually resolve themselves into single fibres which lose their medullary sheaths. Thus, under a higher power, we find that the spaces between the nerve bundles represented in Fig. 1 are in reality filled with a close network of fibres.

As respects location and function, the nerves of the iris may be classified as follows:

(*a*) Principal nerve bundles of various diameters shown at *a*, *b*, *c*, *d*, Fig. 1; they are found chiefly in the middle layers of the iris.

(*b*) Anterior to the principal bundles is a fairly dense network of fine twigs which arise from the principal bundles, anastomose with one another, and form meshes of various sizes. A network of this sort is shown in Fig. 2; *f*. is a bundle of fibres from which arises a network of twigs (*ggg*) rich in triangular and oval nuclei (*ii*); the triangular nuclei lie always at the points of division of the nerves, while the oval nuclei lie in the course of the nerves, and belong to the sheath of Schwann.

The principal bundles contain nerve elements varying in morphology, viz., thick medullated bundles with Ranvier's nodes (Fig. 4, *k*), single medullated nerve fibres with a sheath of Schwann, single non-medullated fibres with a sheath of Schwann (*l*), and, finally, fine non-medullated fibres (*m*).

As respects function, the nerve fibres may be divided into three groups:

(*c*) A dense network of fine non-medullated fibres lies at the anterior surface of the iris (Fig. 2, *h h*), which is to be considered as sensory.

(*d*) Deeper motor fibres arising from the chief network run in a radial direction to the sphincter, and there turning, run among the muscle bundles (Fig. 3).

(*e*) A system of vaso-motor nerves surrounds the vessels of the iris, being particularly thick about the larger arteries.

THE QUESTION AS TO NERVE CELLS IN THE IRIS.

A review of the literature (omitted in this translation) shows that no two writers have had the same ideas in regard to ganglion cells in the iris. In my own preparations I was not able to find any trace of ganglion cells among the fibres of the coarser bundles (as some have described them), nor at the forks of the smaller twigs (as others have described them); and I hold all the structures found at these points and thought to be ganglion cells to be merely nuclei of the nerve fibres. Nor could I find ganglion cells in the sphincter or about the blood-vessels.

In the ciliary body, on the contrary, ganglion cells were unquestionably present.

The nervous network which covers the posterior surface of the ciliary body and of the ciliary processes, and is but indistinctly seen (Fig. 1, *e e*) when a preparation of the iris and ciliary body is viewed from before, is seen quite distinctly when the preparation is viewed from behind. This network consists of nerve bundles having for the most part a radial direction. At the periphery of the preparation, corresponding to the region of the ciliary body, the radial bundles are interwoven with connecting transverse twigs and individual fibres. The nearer the pupillary region, the thinner become the nerve bundles, since they send out fibres in all directions which cover the surface of the ciliary folds, *i. e.*, the radial continuations of the ciliary processes. In some preparations I could see that the nervous network of the ciliary processes stood in connection with the entire nervous system of the iris, through the medium of thick nerve trunks (Fig. 1, *a* and *b*).

In the course of the nerve trunks of this superficial network, particularly in the ciliary region, are scattered cells which are, without question, ganglion cells. They have a fairly large nucleus (6–7 μ), and granular protoplasm. They appear either as bipolar cells 25–28 μ long and 12 μ broad (Fig. 6), or as multipolar cells 12–18 μ in diameter (Fig. 7). Besides the ganglion cells, there are single nuclei lying in the course of the nerves (Fig. 7), which cannot be confounded with the ganglion cells.

Taking into consideration the statements of other writers and my own findings, the question as to the presence of ganglion cells in the rabbit's iris may be answered as follows:

1. In the iris itself, *i. e.*, in the course of its nerves and in the region of the sphincter, ganglion cells are entirely wanting; those who have described ganglion cells as existing here have mistaken for ganglion cells either the triangular nuclei of the nerve fibres, or the branched stroma cells of the iris.

2. Ganglionic structures in the form of bipolar or multipolar nerve cells are found only in the superficial nervous network of the ciliary processes.

As to the function of these ganglion cells—while it is possible that they belong to the motor nervous system of the iris, it is more probable that they belong especially to the ciliary processes, serving as a regulating centre for the vessels and, consequently, for the secretion of the aqueous humor.

My thanks are due to Dr. Greeff for suggesting this theme, and for directing my investigations.

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Explanation of the Figures on Plates III.–IV.

FIG. 1.—The nerves of the rabbit's iris, slightly magnified : (*a*) principal bundles, (*b*) and (*c*) secondary nerve trunks, (*d*) smaller nerve trunks, (*e*) schematic representation of the nerves in the posterior surface of the preparation (nerves of the ciliary body and the peripheral portions of the ciliary folds).

FIG. 2.—Nervous network of the rabbit's iris, more highly magnified : (*f*) a secondary bundle, (*g g*) thin twigs which form a network in the middle layers of the iris, having nuclei (*i i*) at their branchings, (*h h*) thin non-medullated nerve fibres of the sensory network on the anterior surface of the iris.

FIG. 3.—The branchings of the non-medullated nerve fibres among the muscular fibres of the sphincter iridis.

FIG. 4.—A point where the secondary nerve trunks cross : (*k*) a bundle of medullated fibres with Ranvier's nodes, (*l*) bundles of fibres with nuclei of the sheath of Schwann, (*m*) single non-medullated nerve fibres.

FIG. 5.—Stroma cells of the iris stained with methylene blue.

FIGS. 6 and 7.—Bipolar and multipolar ganglion cells from the nervous network of the ciliary body and processes.

SUPPURATIVE KERATITIS.

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AMONG the diseases of the cornea suppurative keratitis is the most important because of its dangerous character. This term includes the purulent ulcer, together with abscess of the cornea, as well as keratitis neuro-paralytica, keratitis ex lagophthalmo, keratomalacia, and keratitis xerotica, but cases of the latter diseases are rarely seen, and the observations in this paper regard only suppurative corneal ulcers and corneal abscesses, which are the forms usually referred to by the term suppurative keratitis.

By suppurative corneal ulcer is meant a loss of substance of the cornea associated with purulent infiltration and destruction of the surrounding tissue. Two forms are distinguished, the serpiginous and the circumscribed suppurative ulcer, the more important of which is the serpiginous, because of its greater gravity.

The serpiginous ulcer, established as a distinct form first clinically by Saemisch, and of late bacteriologically by Uhthoff, Axenfeld, Bach, and Neumann, at first appears as a very shallow ulcer with a smooth or slightly infiltrated floor, which, besides, an inclination to penetrate more deeply, exhibits a pronounced tendency to spread. This tendency always follows a fixed direction, indicated by a characteristic curved, whitish or yellowish-white infiltration of the margin of the ulcer. This infiltration may also appear in the form of several little curved segments, which later blend to

include a great part of the margin of the ulcer, perhaps in isolated and protracted cases surrounding it entirely. Sometimes the purulent infiltration extends for some distance in the layers of the cornea, beyond the margin of the ulcer, so that the margin appears to be undermined. Frequently in place of the infiltrated curved margin there may at first be seen gray, hazy stripes radiating into the cornea from the ulcer. Hess considers these to be opaque folds in Descemet's membrane, though they were formerly explained as cell infiltration. The ends of these stripes may be united, as described by Saemisch, by a gray line running parallel to the border of the ulcer. In other cases the ulcer is from the first surrounded by a more diffuse haziness as it extends, sometimes to involve the entire cornea. In almost all cases an early complication is a severe iritis, indicated by marked ciliary injection, discoloration of the iris, posterior synechiæ, exudation in the pupillary area, and severe pain, which radiates to the temple and vertex. Early changes appear in the anterior chamber. Usually during the first few days a deposit of pus corpuscles, forming a cloudy opacity, occurs on the posterior surface of the cornea at the point which corresponds to the position of the ulcer, and later there is an accumulation of pus at the bottom of the anterior chamber —a hypopyon. Sometimes a yellowish line of pus extends on the posterior surface of the cornea from the ulcer down to the hypopyon, and on this account its origin was formerly attributed to direct transmission of pus corpuscles through the cornea from the ulcer, but it must be considered as settled by the investigations of Leber, Stromeyer, Hoffmann, and Uhthoff that the origin of the hypopyon is from the vessels of the iris, the neighborhood of the pectinate ligament, and the canal of Schlemm. Descemet's membrane was always found intact in non-perforated ulcers, various pigment granules were found in the hypopyon, and the bacteria, so richly present in the progressive margins of the ulcer, were absent in the non-progressive floor.

The size and consistence of a hypopyon are variable. At first it appears as a small yellow crescent at the bottom of the anterior chamber, while in the later stages of the disease it

often becomes so large as to fill the greater part of the anterior chamber. In the latter cases it is difficult to determine how far the purulent infiltration extends over the cornea, because it cannot be distinguished from the hypopyon. At first it is very fluid, and presents a horizontal upper border which moves with each change in the position of the head, but later it may become thick through admixture of fibrin, so as to appear as a globulated, yellowish mass. This condition is observed, according to Saemisch, in about 70 per cent. of all cases. The pains and other annoying symptoms due to the iritis are of very variable character; in some cases the pain is so severe that the patients cannot rest at night, in others the malady is so mild that the patients are first impelled to consult a physician on account of the disturbance in vision after the ulcer has already reached a large size. When an ulcer spreads not only superficially, but also into the deeper tissue, the floor becomes whitish or yellowish-white, infiltrated, and thinner. Sometimes an ulcer appears more superficial than it really is, when the proportionately less cloudy floor is pushed forward under pressure of the aqueous. Unless this process is in some way checked it will often result in purulent infiltration and destruction of a great part of the cornea, perforation, prolapse of the iris, and finally total or adherent leucoma. In large ulcers with thin floors a staphyloma is frequently formed, and in rare cases panophthalmitis results after perforation. As might be expected from its frequently traumatic origin a serpiginous ulcer is almost always to be found in the interpalpebral space, in the central and lower parts of the cornea. After it has run its course, or has been checked at an early period, there always remains a macula or leucoma which, because of its usually central position, materially interferes with vision.

In contradistinction from the serpiginous ulcer we will designate all other purulent forms as circumscribed suppurative corneal ulcers. The nomenclature of these varies in the text-books. Schmidt-Rimpler describes them not as ulcers, but as infiltrations, Saemisch as inflammatory deep corneal ulcers, while Uhthoff and Axenfeld call them "atypical

hypopyon-keratitis," a name also proposed by Vossius. Others, on the contrary, restrict the name hypopyon-keratitis to the serpiginous ulcer. In the classification of the forms of suppurative keratitis, the designation hypopyon-keratitis may with propriety be excluded, for, as F. W. Hoffmann says, hypopyon indicates only one symptom, dependent on the intensity and duration of the disease, which may appear in the course of any infectious keratitis and does not belong exclusively to any one form of ulcer. As a matter of fact, hypopyon may be absent in all forms of suppurative keratitis. These circumscribed suppurative ulcers, although they may spread superficially, show no pronounced tendency to do so, but rather to penetrate more deeply, and they present irregularly infiltrated floors and margins, with striated or diffuse opacity of the cornea in the neighborhood. Iritis and hypopyon are present as in serpiginous ulcers, but are usually of less intensity. On account of the tendency to penetrate deeply in this form of ulcer, perforation occurs with comparative ease, usually causing an arrest of and recovery from the ulceration, often with the formation of a leucoma adherens. These ulcers seldom attain a great size, and, aside from the danger of prolapse of the iris and its attendant consequences, are much less serious than the serpiginous variety. They rarely occasion complete loss of the eye, several are sometimes present in the same eye, and they are not confined as to situation to the interpalpebral space.

Under abscess I include only the circumscribed masses of infiltration in the cornea, beneath an intact outer surface, which, by their yellow color, or by the presence of a hypopyon, prove themselves to be suppurative. They are usually round, single or multiple, of a grayish or yellowish-gray color. Sometimes primarily small and multiple abscesses merge in the course of the disease to form one large abscess. Usually they attain no great size, except in such virulent varieties as that observed by Schweigger during an epidemic of smallpox. In its later stage the abscess may become an ulcer through destruction of the superficial layers of the cornea, but this is by no means the invariable course, and it may retrograde without damage to these superficial layers,

leaving behind a circumscribed interstitial opacity. These abscesses are very rare.

The following remarks are based on the cases of suppurative keratitis, with the above-mentioned limitation in meaning, which were treated between April, 1893, and September, 1898, in the Königlichen Universitäts-Augenklinik in Berlin, together with those seen at the Poliklinik during the summer of 1898. Among the 4877 patients who received hospital treatment during this time, 237 had suppurative keratitis—4.8%; 205 of these were cases of serpiginous ulcer, 27 of circumscribed suppurative ulcer, and 5 of abscess. To these we add 24 cases seen at the Poliklinik, of which 16 were serpiginous ulcers, 8 circumscribed suppurative ulcers, and 1 an abscess.

It is well known that in a great many cases suppurative keratitis, particularly serpiginous ulcer, is caused by a slight superficial injury of the cornea. Country people at harvest time present with comparative frequency serpiginous ulcers which have resulted from slight injuries to the cornea from beards of rye, straws, etc.—the keratitis of reapers. Saemisch in his first paper on this disease found an antecedent injury in 40% of his cases, but later writers have found the percentage much greater. Hillemanns found an antecedent traumatism in 43 out of 57 cases, Schmitz in 70.6% of males and 47% of females, Wehrle in 70%, and Vossius in 63.16%. Of the 221 cases of serpiginous ulcer here presented, 119, 53.8%, were known to be of traumatic origin. Probably this percentage would be higher were it not that many patients pay little heed to the slight injuries of the eye to which they are accustomed to be exposed in their daily work, and often have forgotten them on account of their insignificance. Schmitz and Vossius have expressed the opinion that the serpiginous ulcer is always occasioned by an injury.

In our cases the traumatism was inflicted:

38 times by beards of rye, straws, haystalks;
19 " " twigs;
15 " " bits of stone;
11 " " sand or dust;
6 " " bits of iron or other metal;

6 times by splinters of wood;
4 " " lac, pitch, or tar;

once each by finger-nail, machine-needle, horse's tail, flies, friction of eyelashes, and sulphuric acid. Eleven patients could not tell the nature of the offending body. In this compilation injuries received in agricultural work are the most numerous. Unfortunately, these patients very often apply for treatment too late, after a considerable portion of the cornea has been destroyed. This is due in part to social conditions, in part to the indifference of the patient, and also, as Vossius claims, in many cases to the red-tape of sick-benefit societies, which prevents for several days the entrance of the patient into the hospital. Meantime the ulcer may have attained such extent that there is little vision left to be saved.

As the serpiginous ulcer is usually occasioned by traumatism, it should be expected to occur more often in men than in women. Of our 221 cases, 137 were in men, 84 in women. Of Schmitz's cases, 178 were in men, 83 in women, and Vossius found it in 258 men and 87 women. The serpiginous ulcer occurs most often in the poorer classes of working people, because they are more liable to injuries of the eye, and because diseases of the tear passages, conjunctiva, and lids, which are important in the etiology of this form of ulcer, are most frequently met with in this class of people.

Blennorrhœa of the lachrymal sac was early recognized as a frequent and dangerous complication of the serpiginous ulcer. Saemisch states in his *Handbuch* that he found dacryocystitis present in 32% of his cases, while Schmidt-Rimpler found it in 54%.

The observations of Vossius and of Schmitz show that of 345 cases, 186, 53.9%, presented serious complications, 155 on the part of the lachrymal passages, 31 on the part of the conjunctiva and lids. Schmitz found dacryocystitis almost twice as frequently in women as in men, in the former in 53%, in the latter in 27.7%. Of our own cases, 89, 42.2%, had dacryocystitis, and they confirm the observation of Schmitz with regard to its relatively greater frequency in women, as it occurred in 57.2% of the women, but in only 29.6% of the men.

Information as to the connection between purulent keratitis and dacryocystitis has been obtained by means of experimental inoculations of the cornea by Eberth, Leber, and Stromeyer. This is certain, that purulent keratitis may be an inflammation which results from septic infection of a corneal wound and that thus the purulent secretion from the lachrymal sac plays an important part in its causation. The best evidence of this is furnished by direct inoculation of the cornea with the secretion of the lachrymal sac, as done by Schmidt-Rimpler. Lately the true excitant of infection in cases of serpiginous ulcer has been bacteriologically demonstrated. This was first declared to be the pneumococcus by Gasparini and Basso, and later Uhthoff and Axenfeld were able to obtain from the margins of almost all cases of serpiginous ulcer pure cultures of the pneumococcus, so that there is little doubt as to the specific excitant of this form of ulcer. In only a very slight number of cases of atypical suppurative keratitis could pure cultures of pneumococci be obtained, the cultures usually showing a mixture of other micro-organisms, staphylo- or streptococci, and bacilli, or a mixture of these with pneumococci. These micro-organisms are not usually introduced by the injury into the corneal wound, except in those rare cases caused by the aspergillus fumigatus, but are brought into it by a secretion in the conjunctival sac or by improper behavior on the part of the patient. According to the above-mentioned authors pneumococci are often found in secretions from the lachrymal sac, in the saliva and nasal discharges, occasionally in certain forms of conjunctivitis, and sometimes on the normal conjunctiva. Staphylococci and streptococci are found in the normal as well as in the pathological conjunctival sac. The pneumococci can be found only in the spreading margins of the ulcers, neither within the eye nor in the hypopyon. This freedom of the hypopyon from bacteria explains the fact that it is usually well tolerated by the eye and that it is often quickly absorbed, leaving no injury behind. Through their metabolic products, toxines, the cocci excite the purulent irido-cyclitis which occasions great pain and the formation of the hypopyon. It has been mentioned that

hypopyon is not present in all cases. We found among our 221 cases, 198 with, 23 without, hypopyon, so it was absent in 10.4 %.

It should also be mentioned that there is a decidedly greater disposition toward serpiginous ulcers in elderly than in young persons. Most of the cases were observed in patients between 40 and 70 years of age. A division of our cases according to age gives this result: Patients of 10 years of age and under, 1; between 10 and 20 years, 6; between 20 and 30, 13; between 30 and 40, 28; between 40 and 50, 55; between 50 and 60, 65; between 60 and 70, 37; of 70 and upwards, 16. One explanation of its rare occurrence in children is that the cornea is then more resistant to infection, another, that dangerous complications on the part of the lachrymal passages are much rarer in childhood than in adult life.

The treatment of the serpiginous ulcer has by degrees become very successful, though there are still cases in which the destruction of the cornea progresses steadily in spite of any treatment whatever. Roser, who, fifty years ago, first described purulent keratitis under the name of hypopyon-keratitis, had to admit the almost complete inability of treatment to check its extension. A great advance was made by A. von Graefe, who recommended the use of warm instead of cold applications, atropine, and a pressure bandage, a treatment still employed in the early stage of a serpiginous ulcer, and denominated medicinal. He also recommended to dilate the lachrymal sac, to express its contents frequently, to touch the floor of the ulcer with a 1 % solution of silver nitrate, and he introduced the operation of paracentesis of the anterior chamber. An attempt to control the ulcer by means of an iridectomy he abandoned as useless. Some years later he proposed the use of chlorine water, which is even yet used in this hospital as a cleansing agent in purulent keratitis. In 1870 Saemisch brought forward, simultaneously with his clinical description, incision across the ulcer, keratotomy, to check its progress. He halved the entire floor, in the direction of progress as shown by the margins, with a small knife entered and brought out in

healthy corneal tissue, the edge directed upward, the wound to be opened daily until after the infiltration has been destroyed. This operation was received with great warmth at the time and is often performed even now with good results, although many disadvantages are connected with it. After it was recognized that purulent keratitis depended on septic infection, a great number of antiseptics, corresponding to the progress of antisepsis, were tried, but many were not tolerated by the eye. Schweigger is right when he says that "the greatest triumph of antisepsis is in the prevention of traumatic diseases; if a septic infection has once taken place, the bacilli and cocci are able to offer greater resistance to antiseptics than the delicate tissues of the eye, in which they have nestled." Of all the agents which have been tried, the only ones worthy of retention are chlorine water, iodoform, and solutions of corrosive sublimate and of boric acid.

The use of antiseptics developed a new operative treatment, cauterization. Martinache used the actual cautery, Sattler and Nieden recommended a suitable form of the galvano-cautery, and Eversbusch added the thermo-cautery for this purpose. Some form of the galvano-cautery, by means of which the ulcer is touched with a fine, hot platinum loop, is now generally used in this hospital as well as elsewhere. As a result of the good results which Nieden obtained with the galvano-cautery in suppurative keratitis, this treatment has become acknowledged by most ophthalmologists as the most efficacious and the least dangerous.

In 1884, Schiess recommended the linear cauterization with a fine caustic pencil of the lower conjunctival fold when greatly swollen in cases of serpiginous ulcer. Although, according to Fisch and Wehrle, this treatment affords good results, it has not been much employed. The subconjunctival injections of corrosive sublimate, once extolled, may be laid aside as useless and sometimes dangerous in suppurative keratitis. Subconjunctival saline injections, as recommended by Mellinger, have also thus far proved of little use.

The treatment usually instituted in this hospital for a serpiginous ulcer is as follows: The eye is first thoroughly

cleansed with a 1:5000 solution of corrosive sublimate. If the ulcer has not yet attained any considerable size, the further treatment is that termed medicinal, the instillation of atropine and of chlorine water, bathing with warm solutions of corrosive sublimate or of boric acid, and the application of a moist dressing. Atropine is used very freely at first, sometimes conjointly with scopolamine, to obtain the greatest mydriasis possible. Chlorine water is used almost exclusively in this hospital as an antiseptic collyrium, not only in serpiginous ulcers, but also in all forms of suppurative keratitis. The solution used should be perfectly fresh, because after long standing it loses its efficiency and becomes an irritant. It is usually instilled simultaneously with atropine, sometimes hourly. In large ulcers with much secretion iodoform is also used, but this is not equally tolerated by all patients. A pledget of cotton wet with a 1:5000 solution of corrosive sublimate is laid on the eye, covered with a piece of rubber tissue, over this a layer of dry cotton, and then a bandage is applied. When corrosive sublimate is not well borne, boric acid may be substituted.

When the discharge is considerable, the dressing is renewed in the evening after washing out the conjunctival sac. Experience has proven that a large number of serpiginous ulcers, taken in the beginning of the inflammation, may be checked and cured under this quiet, conservative treatment, and that it is not necessary and should not be recommended, as is done by some, to cauterize every serpiginous ulcer. Statistics show that about half of all cases recover under this medicinal treatment.

It is very important to remove immediately any disease of the lachrymal sac if present. In this hospital the most radical measures are adopted; if a serpiginous ulcer is complicated with dacryocystitis, the lachrymal sac is opened externally, tamponed daily, or, when there is much discharge, twice a day, with iodoform gauze, and sometimes extirpated. The suppuration is but insufficiently removed by probing and washing out the sac, and this leaves the ulcer consequently exposed to the constant danger of an inundation of pus. Total extirpation of the sac is a most rational pro-

cedure: it removes forever the danger, which is of special importance in those cases which recover with a leucoma adherens, and deserves to be performed much more often than it has hitherto been. The operation is usually easily done, though sometimes it is prolonged and difficult on account of free hemorrhage. The wound heals in a few days, the linear scar is after a short time not noticeable, and the slight epiphora, which sometimes remains, does not trouble the patient. A very good technique is that proposed by Kuhnt in 1888. The nail of the left thumb is placed on the anterior lachrymal crest, and an incision 2.5 *cm* long, made down to the bone. The incision should begin 4 *mm* above the internal palpebral ligament, and extend to 5 *mm* above the commencement of the bony naso-lachrymal canal. In this way one cuts down with certainty upon the lachrymal sac, and does not so easily cut into the orbital fat. The sac is then dissected out entire, beginning at the inner wall, and the wound is closed with sutures.

If while under the medicinal treatment the ulcer spreads, then cauterization, particularly of the infiltrated part, is indicated, and in case a large hypopyon is present, either perforation of the floor of the ulcer with the galvano-cautery or, if the hypopyon is very large and apparently viscid, paracentesis at the sclero-corneal margin. It is always important to open the anterior chamber, whenever a considerably large hypopyon is present, in order to let out the pus, together with the aqueous humor, which is full of toxines. The perforation should always be very small, punctiform, and, if possible, in the pupillary area. A small hypopyon may be allowed to become absorbed spontaneously. When the patient first comes under observation, cauterization is indicated when the ulcer has already lasted some time, is of considerable size, and shows a decidedly progressive character by the marked infiltration of its margins. On the other hand, in such ulcers as have spread over the entire cornea, operative intervention is hopeless, and they should receive only the medicinal treatment, except that a paracentesis may be made to evacuate a large hypopyon when present. Cauterization is well borne by the eye, and the annoyance it occasions

soon passes away. If after the first cauterization the ulcer continues to spread, the operation should be repeated. When there is a large hypopyon, it is advisable to delineate the infiltrated portion of the cornea by means of fluorescin, which, as described by Nieden, in about a minute after instillation, and after washing out the conjunctival sac, renders the affected area plainly visible by changing its color to green or greenish yellow. When perforation of the ulcer is threatened, a pressure bandage should be applied, and the patient placed in bed, in order to prevent, or at least delay, this accident, and to avert a large prolapse of the iris. If the ulcer is in the reparative stage, and the condition of irritation almost gone, an ointment to aid in clearing up the cicatrix can be ordered. After complete recovery, an iridectomy for visual purposes may be performed, but a noteworthy improvement is seldom obtained thereby.

If we turn now to the treatment of our 221 cases of serpiginous ulcer, we find that medicinal treatment alone was used in 94, operative in addition in 127. Of the 94 cases, 82 recovered under this conservative treatment, leaving behind a macula or leucoma. In 10 cases this treatment was instituted because when first seen the cornea was quite, or nearly quite, infiltrated, in some perforated. In 5 of these cases exenteration was performed on account of panophthalmitis shortly afterward, 3 cases resulted in a total or nearly total leucoma, 1 in staphyloma, 1 in phthisis. Of the remaining two cases, one was prematurely discharged, the other refused operation,—in this the result was total staphyloma.

Cauterization was employed in 102 cases, in 73 once, in 29 more than once, usually two or three times. Simultaneously with the cauterization perforation on the floor of the ulcer with the galvano-cautery was performed 19 times, paracentesis 8 times. In 2 cases after previous cauterization, as the hypopyon showed no tendency toward absorption, an additional paracentesis was performed, in one case after a previous puncture, as the ulcer continued to spread after it had been cauterized. In 92 of these 102 cases the process was brought to an end by the cauterization, in 8 the ulcer continued to spread in spite of the treatment, and 2 patients

left prematurely. This intervention was therefore successful in 92%, unsuccessful in 8%. The results in the 8 unsuccessful cases were: in 4 total or nearly total leucoma, in 3 staphyloma, in 1 panophthalmitis.

Keratotomy was the sole treatment in only 6 cases. In all, the ulcers were cured, in 4 with the formation of a leucoma adherens. In one of these cases, in which a prolapse of the iris occurred at one end of the incision, a fresh inflammation broke out about four weeks after the healing of the ulcer, which resulted in panophthalmitis.

Cauterization and keratotomy (Saemisch's incision) were done in 9 cases. In 3, after a fruitless keratotomy, cauterization effected a cure, and, on the other hand, twice after cauterization had failed keratotomy proved effective, each time with the production of an anterior synechia. In 4 cases in which the ulcers were very large and widespread, the use of both of these means failed to check the extension of the suppurative process; in 2 cases the result was total leucoma, in one staphyloma, and in one phthisis.

Paracentesis was performed in 8 cases in which a large and apparently firm hypopyon was present. In 5 the ulcer healed after this treatment alone; in 2, where the ulcer had involved the greatest part of the cornea, so that any other treatment seemed hopeless, it failed; 1 case left prematurely.

In a case of serpiginous ulcer which had developed in a glaucomatous eye, iridectomy induced healing of the ulcer.

Subconjunctival injections of corrosive sublimate were tried several times, but with no good results, so that other methods had to be employed. In one case a very severe chemosis of the conjunctiva, which occasioned a new marginal ulcer, followed the injection.

No conclusion as to the value of a method of treatment can be derived from the degree of vision saved in these cases, as that depends much on the position of the ulcer. The essential question to be answered is, What method is the fittest and the surest to check the spreading of the ulcer on the cornea? Our experience in this hospital enables us to advocate as such a method cauterization of the ulcer, with or

without galvano-puncture of its floor or paracentesis. Galvano-puncture is sufficient for the evacuation of a medium-sized fluid hypopyon, while paracentesis is to be preferred when the hypopyon is very large and apparently viscid. Paracentesis may also be preferred when a deep ulcer with a thin floor is associated with a small pupil, as it may prevent the occurrence of a spontaneous perforation, which heals with difficulty, and the formation of an anterior synechia. In the 19 cases treated by perforation of the floor of the ulcer, leucoma adherens was observed 5 times. Schmitz in his article on the treatment of serpiginous ulcer, declares cauterization to be inferior to keratotomy for the typical case, because the severer forms, not amenable to the medicinal treatment, are not suitable for cauterization, but this opinion must certainly be based on an insufficient experience with the method. Cauterization produces at least as good results as, if not better than, keratotomy in all forms, even the worst, of serpiginous ulcer, without the disadvantage of causing anterior synechiæ. Nieden obtained out of 100 cauterized cases of destructive keratitis, most of which were serpiginous ulcers, 88% recovery, 12% leucomata, no case of phthisis. He obtained similarly good results in a second hundred of cauterized cases, 85 cases of serpiginous ulcer, of which 75 recovered with maculæ, 10 with leucomata. Such remarkably good results can be explained only by the absence among Nieden's cases of such bad ones as may frequently be seen in this hospital. Schultz reports on 109 cases of serpiginous ulcer treated at Jena: 45 were cauterized, all with success; in 31 after a single application, in 14 after more than one. Vossius reports 83 cases of cauterization, combined 36 times with perforation. In 18 of these cases the final vision was unknown, in one nil, in 6 perception of light, and in the rest a measurable quantity. In 87 of the 119 cases, cauterization was performed only once, in 32 cases it was repeated.

As regards keratotomy, this method is objectionable in that it is apt to cause anterior synechiæ; the occurrence is to be avoided if possible, as they are of themselves a source of danger to the eye. Of Hillemann's 25 cases 23, 99 %, recov-

ered, but 15,60 %, with anterior synechiæ. Of Schmitz's 138 cases, 126,91 %, were successful, but of these 91, or about 75 %, had leucoma adherens. Vossius reports 53 cases treated with combined cauterization and keratotomy, and 22 with keratotomy alone, and in 35 out of these 75 cases a resultant leucoma adherens. This danger of the formation of anterior synechiæ is present not only in large and deep ulcers, but in all in which the incision extends beyond the usually narrow pupil, which it is difficult to dilate with atropine. Beyond question the frequent reopening of the wound also favors this accident. In this hospital the operation is seldom performed, as compared with cauterization, and then only in cases in which the ulcer is associated with a large and apparently firm hypopyon. Usually in such cases cauterization is also used. Keratotomy may be preferable when an ulcer in the lowest part of the cornea has an infiltrated and ruinous floor, because a smooth cut directly through the infiltrated tissue is better than an oblique one through the same. It may also be better when the ulcer is very extensive and with a very thin floor, because a large anterior synechia is preferable to a staphyloma, the probable result in such cases. Keratotomy in spite of its undoubted effectiveness is then not as universally applicable as cauterization, but is restricted to a certain class of cases.

If we turn now to the second class, the circumscribed suppurative ulcers, we find that 27 cases were observed in the hospital during the time stated, and 8 at the poliklinik. This comparatively small number is due to the fact that this form of ulcer requires hospital treatment less often than the serpiginous variety. Of these 35 cases, 31 were in children under eleven years of age, 4 in adults. In 25 of the children a hypopyon was present, but smaller than is usual in serpiginous ulcer; in 6 it was absent, but that the ulcers were suppurative was evident from their yellowish appearance. In 22 cases the ulcer originated in a scrofulous keratitis, in 3 from purulent conjunctivitis. In one case an old leucoma adherens set up a severe purulent inflammation with hypopyon. In 4 cases no special cause could be ascertained. In only 1 case had there been an injury. Of the 4 cases in

adults, 2 resulted from protracted purulent conjunctivitis, 1 originated spontaneously, and 1 from an indefinite injury. The ulcers were without hypopyon, exhibited no special tendency to spread, and their floors and borders were irregularly infiltrated. In none of the 33 cases was dacryocystitis present.

The treatment in 23 of the cases consisted of atropine, chlorine water, warm applications, and perhaps a moist dressing. The dressing was naturally contraindicated in all cases where there was much discharge from the conjunctiva, and in such cases astringents and cold applications were used. Spontaneous perforation occurred in 4 cases, and resulted in 3 in the formation of an anterior synechia. After perforation recovery was rapid. Cauterization was employed in 10 cases, combined twice with puncture, once with perforation, in each case with good result. No loss of the eye occurred in any of the 38 cases. As compared with the serpiginous ulcer the circumscribed suppurative ulcer is innocuous. It is usually amenable to medicinal treatment, and only on account of a very protracted course, superficial extension, or a moderately large hypopyon is cauterization, perhaps with paracentesis or galvano-puncture, needed. It is quite proper in an ulcer which threatens to perforate, to puncture the floor of the ulcer with the galvano-cautery, or with a needle, in order to prevent a sudden irruption with a greater prolapse of iris. The re-formation of the anterior chamber will then be hastened by the application of a pressure bandage. When the ulcer showed itself to be recovering, the use of ointments was begun, especially when it was of scrofulous origin. A general tonic treatment may hasten the recovery of these cases, which often run a very prolonged course.

During the 5½ years, cases of true abscess of the cornea seldom came under observation,—only 6 in all. In 2, several little collections were present, which later united to form one large abscess. In 4 of the 6 the abscess was accompanied by hypopyon, in all by a very painful iritis. Five occurred in men between the ages of forty and forty-five, 1 in a child who had frequently suffered from a recurrent scrofulous keratitis. No cause could be assigned for the

occurrence in any of the adults. The treatment instituted was atropine, warm applications, and a moist dressing, to which was added diaphoresis for the purpose of hastening the process of absorption. In one case the morbid process was checked, leaving behind an interstitial cloudiness in place of the abscess. In another case, in which several deposits had united in one large abscess, recovery with a macula was obtained by cauterization. In a third case many little abscesses were repeatedly cauterized and punctured in vain, and finally the patient voluntarily withdrew. In 2 cases recovery was obtained after keratotomy, 1 with a leucoma adherens. In one of these cases paracentesis with evacuation of the hypopyon was insufficient to bring about the healing of the abscess. The fifth case, in the child, recovered under medicinal treatment, leaving an interstitial cloudiness.

In this form of suppurative keratitis also, non-operative treatment should be first tried, and operative procedures instituted if the abscess increases in size or is accompanied by a large hypopyon. Then is indicated cauterization of the entire abscess, together with paracentesis to evacuate the hypopyon, especially in multiple small abscesses, while keratotomy should be reserved for those cases in which there is a large abscess reaching far into the tissue, cauterization of which in its entirety would create an ulcer with a very thin floor.

ON THE CHANGES IN THE EYE AFTER LIGATION OF THE GALL BLADDER (AN EXPERIMENTAL CONTRIBUTION TO THE KNOWLEDGE OF OPHTHALMIA HEPATICA).[1]

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(*With 14 figures on Plates XI.–XII. of vol. xxxiv., German edition.*)

IT has long been recognized that in general diseases various pathological changes occur in the eye, affecting chiefly its vascular and nervous apparatus. The effect of the general disease manifests itself in inflammatory or degenerative processes in the tissues of the eye when the toxic agent in the blood exerts a distinct influence on the tissues. At times, however, degenerative processes in the eye stand in no direct connection with a general disease, but develop gradually as the result of the increasing general emaciation. The most probable cause of all the pathological changes occurring in the eye in general diseases and intoxications is an abnormal chemical composition of the blood, consisting in changed quantitative relations in its component elements or in the addition of various chemical organic poisons. After what has been said, it seems strange that so few observations and scientific investigations have been made regarding the ocular changes accompanying diseases of the liver—an organ whose disorders give rise to various alterations in the chemical composition of the blood. The little clinical attention paid to the matter is perhaps

[1] From the laboratory of the Berlin University eye clinic.

due to the fact that the ocular changes which are observed in diseases of the liver are rarely of high degree, and pass unnoticed among the more violent symptoms on the part of other organs, so that they are little regarded either by physician or patient. This paucity of clinical observation is, furthermore, the reason that experimental studies of the matter have rarely been undertaken, the papers by Althoff-Müller and Zitten being the only ones on the subject.

The present paper contains a description of the pathological changes found in the eyes of four dogs which died following ligation of the common bile duct. After the operation some of the dogs lived as long as one hundred days. For the eyes I am indebted to Dr. Werbitzski, and an abstract of the changes which he found in the other organs appears later in this paper.

[A résumé of the literature, occupying eleven pages, is here omitted.—*Trans.*]

The results of previous observations in ocular affections in connection with diseases of the liver may be tabulated as follows:

SUBJECTIVE SYMPTOMS.

1. Amblyopia and amaurosis (Himly, Ruete, Bischoff, Landsberg, Baas).
2. Hemeralopia (Kochling, Ruete, Bamberger, Fumagalli, Strauss, Cornillon, Parinaud, Gorecky, Litten, Maully, Weiss, Leber, Baas, Hori).
3. Xanthopsia (Hofmann, Frank, Stokes, Bamberger, Strauss, etc.).
4. Erythropsia (Junge).
5. Defective perception of color (Parinaud, Weiss, Hori).
6. Scotomata (Parinaud).
7. Concentric contraction of the visual field (Weiss, Hori).

OBJECTIVE SYMPTOMS.

1. Hemorrhages in the retina (Junge, Stricker, Buchwald, Zitten).
2. Œdema of the retina (Fumagalli, Poncet).
3. Inflammatory and degenerative processes in the retina

and atrophy of the retina (Junge, Müller and Althoff, Weiss, Baas, Hori, Pasadsky).

4. Pigmentary inflammation of the retina (Landolt, Litten, Hori).

5. Neuro-retinitis (Weiss, Baas, Hori).

6. Inflammatory and degenerative processes in the uveal tract (Weiss, Baas, Hori).

7. Dryness of the mucosa of the eye (Weiss, Leber, Baas).

All the clinical symptoms have been explained fully by the microscopic examinations.

MICROSCOPIC CHANGES.

1. In the optic nerve: œdema, infiltration with leucocytes, and atrophy of the peripheric fibres.

2. In the retina: œdema, inflammatory processes in the walls of the vessels, proliferation of the nuclear layers, alterations in the pigment epithelium, formation of new connective tissue, different degenerations of the nerve cells, and sometimes complete atrophy of the entire retina.

3. In the choroid: inflammatory infiltration, thickening of the walls of the vessels, and new formation of connective tissue, at times leading to complete disappearance of the choroidal tissues.

The pathological changes that I found in the dogs' eyes were for the most part the same as those that have just been mentioned, but before proceeding to the detailed description, I wish to present the conclusions at which Dr. Werbitzski arrived after examining the internal organs of the dogs that died after ligation of the bile duct.

1. Animals may live as long as one hundred days after ligation of the bile duct.

2. In the course of this time they become anæmic, but this is due rather to a mucoid degeneration of the bone marrow than to the alterations in the blood due to elements of the bile.

3. In the liver cirrhotic changes occur which lead to an atropic, granular liver, with corresponding clinical symptoms.

4. In the kidneys there are parenchymatous changes, the glomeruli being affected at the same time with the epithelium.

5. The intestines exhibit a catarrhal affection with a tendency to hemorrhage.

6. The icterus, which does not always appear, decreases in time, perhaps in consequence of the lessened bile-producing power of the liver.

7. The pulse of the animals is accelerated while the respiration remains unchanged.

8. The weight of the animal steadily decreases, the nutrition is disturbed, and the temperature falls.

It appears likely that all these changes, and the unavoidable death of the animal, are due to altered metabolism, and the condition of the urine also indicates this.

The dogs whose eyes I examined lived two or three months after the ligation.

First Dog.—The optic nerve is œdematous and its bundles are separated in many places by empty spaces. The connective tissue throughout the nerve is moderately infiltrated with uninuclear leucocytes. The disc is swollen and markedly infiltrated with leucocytes, but this infiltration diminishes in the nerve-fibre layer of the retina, and farther back in the nerve. The vessels of the optic nerve are filled with blood. Two vessels, however, are partly filled with a thick granular mass attached to the vessel wall, staining blue with hematoxylin and rose with Van Gieson's stain. The vessels of the retina are filled with blood, and the vessels of the choroid are dilated. The nerve-fibre layer of the retina contains a transuded liquid which has forced the fibres apart. This œdema is more marked in the nerve head, and gradually diminishes toward the ciliary body. There is also an infiltration of this layer with leucocytes, some of which have undergone fatty degeneration. The ganglion-cell layer is œdematous, and many of the cells have undergone various sorts of degeneration. The outer layers of the retina are œdematous, and the nuclei in the two nuclear layers are irregularly increased in number. Furthermore, nuclei of the outer layer have pushed through the membrana limitans externa, and lie among the rods and cones. The latter are swollen and partly broken down into myelin drops. In places a fibrinous exudation lies between the retina and choroid.

Many of the choroidal vessels are distended, and a fibrinous exudation is seen about the vessels and through the choroid generally.

The vitreous in its peripheric portion contains a fibrinous exudation.

To sum up, there were found inflammatory changes as follows: (1) œdema of the optic nerve and retina; (2) distension of the vessels of the retina and choroid; (3) an infiltration of the optic nerve and the nerve-fibre and ganglion-cell layers of the retina with leucocytes; (4) a fibrinous exudation between choroid and retina, and in the choroid itself; (5) beginning thrombosis of individual retinal vessels; (6) increased thickness of the nuclear layers of the retina, and (7) a fibrinous exudation in the vitreous. Besides these inflammatory changes, degenerative changes were found in the ganglion cells, rods and cones, and pigment epithelium. The case then was one of beginning inflammation of the optic nerve, with an advanced exudative inflammation of the retina and choroid.

Second Dog.—The optic disc is densely infiltrated with leucocytes, but the infiltration is less marked farther back in the nerve and in the nerve-fibre layer of the retina. The optic nerve and inner layers of the retina are œdematous. The retinal and choroidal vessels are distended with blood, the endothelium is swollen, and in the retinal vessels there are evidences of perivasculitis. Many of the retinal ganglion cells are degenerated. The nuclei of the nuclear layers are increased in number. The rods and cones are partly broken down. The pigment has, to a considerable extent, wandered out of the pigment epithelium. There is a fibrinous exudation in the periphery of the anterior chamber.

The changes found in this case were similar in nature to the changes found in the first dog. There was here a well marked neuritis and perineuritis, accompanied by a less marked inflammation of the choroid and retina.

Third dog.—In the optic nerve there is a slight infiltration with round cells continuing into the inner layers of the retina and a short distance back in the nerve. The nerve-fibre and ganglion-cell layers of the retina are œdematous and the vessels are congested. The ganglion cells are degenerated in various ways, the rods and cones are broken down, and the pigment has wandered out of the pigment epithelium.

The changes here are those characterizing the beginning of an inflammatory process in the retina.

Fourth dog.—The optic disc is infiltrated and œdematous, as are also the nerve-fibre and ganglion-cell layers of the retina. The ganglion cells are degenerated in various ways. The cells of the nuclear layers are increased. Müller's fibres are thickened. The retinal and choroidal vessels are distended with blood. In the choroid and between it and the retina and in the vitreous are fibrinous exudations. The usual degenerative changes in the rods and cones and pigment epithelium were found.

We had here to do, therefore, with a well marked exudative inflammation of the retina and choroid and a beginning inflammation of the optic nerve.

From these findings we may draw the following conclusions:

1. After ligation of the common bile duct the coats of the eye undergo very pronounced changes of inflammatory and degenerative characters.

2. The changes are found in the stroma of the connective tissue, in the vascular system, and in the nervous elements.

3. The changes in the connective tissue consist in the proliferation of the nuclei.

4. The alterations in the vascular system comprise distension of the vessels, swelling of the endothelium, perivasculitis, enlargement of the spaces about the vessels, hemorrhages, and exudations.

5. The affections of the nervous system consist in various degrees of degeneration of the protoplasm of the ganglion cells, alterations in the nuclei, and enlargement of the spaces about the cells.

All these changes point to a distinct cause for their origin and development and one cannot consider them to be simply the expression of lowered general nutrition.

In conclusion, I wish to express my thanks to Dr. Greeff, who has kindly examined all of my preparations.

Explanation of the Figures on Plates XI. and XII.

FIG. 1.—A ganglion cell lying in a cavity produced by œdema of the stroma of the retina.

FIG. 2.—Œdematous ganglion cell surrounded by large cavities.

FIG. 3.—Œdematous ganglion cell surrounded by leucocytes.

FIG. 4.—Œdematous ganglion cell containing a leucocyte (?).

FIG. 5.—Peripheric vacuolation of a ganglion cell.

FIG. 6.—Central vacuolation.

FIG. 7.—Fatty degeneration of a ganglion cell.

FIG. 8.—Almost total destruction of the cell body.

FIG. 9.—Beginning emigration of the nucleolus.

FIG. 10.—The nucleolus lying distinctly outside the nucleus.

FIG. 11.—Vacuolation and beginning destruction of the nucleus of a ganglion cell.

FIG. 12.—Complete necrosis of a ganglion cell.

FIG. 13.—Œdema of the retina: (*a*) empty cavities of various sizes in the stroma, (*b*) exudation replacing a cell, (*c*) thickened Müller's fibres.

FIG. 14.—Œdema of the retina: (*a*) breaking down of rods and cones, (*b*) formation of sharply outlined cavities, (*c*) hypertrophy of the outer nuclear layer, (*d*) a nucleus in the act of passing through the limitans externa, (*e*) separation of cells by œdema.

A CONTRIBUTION TO THE SUBJECT OF TUBERCULOSIS OF THE CONJUNCTIVA.

By Dr. CARL GRUNERT.

FIRST ASSISTANT TO THE UNIVERSITY EYE CLINIC AT TÜBINGEN.

Abridged Translation by Dr. Ward A. Holden.

THE fact that tuberculosis of the eye appears for the most part without signs of tuberculosis elsewhere, and often in perfectly healthy persons, and the fact further that its course is often mild and benign, long kept us from studying this form of disease, so that our knowledge of it dates back only a few decades. Disseminate tuberculosis of the choroid is excepted, of course, for that was recognized very early as a symptom of acute miliary tuberculosis, and proper importance was attached to it.

Only since 1873, when Perls wrote on tuberculous iridocyclitis, has the literature of chronic tuberculosis of the eye been gradually increased by reports of cases, but the study was much facilitated by the introduction of methods for discovering the bacillus, and of inoculating the disease in rabbits' eyes. Case after case, however, has shown that the disease is much more frequent than we had supposed, and that only the lack of differential points in diagnosis prevented it from being distinguished from the mass of ulcerous, granular, and simple inflammatory affections. It is noteworthy to observe in the literature with what hesitancy observers admitted that one part of the eye after another was subject to tuberculosis.

In 1867 Virchow considered the conjunctiva immune to tuberculosis. In 1870 the first cases of tuberculous con-

junctivitis were reported. In 1887 Amiet collected 47 reported cases, and in 1895 Denig found 73. I am adding another case to this number, not because the disease is relatively rare, but because my case differed in etiology and symptomatology from the most, and because of the therapeutic measures employed.

C. L., a printer, aged twenty-seven ; father living, and healthy; mother and a maternal uncle died of phthisis ; patient's brothers and sisters well. The patient has never been robust, and has suffered from catarrhs of all sorts, but has never been seriously ill. In 1890 he noticed lachrymation of the left eye, and a year later the canaliculus was split, and the lachrymal duct probed, after which there was some improvement. At this time he was under treatment for a catarrh of the apex of the lung. Three months later a small swelling was noticed on the upper lid, and in time it grew larger. In the spring of 1893 this nodule was removed, but later several more appeared. In 1894 these were operated on several times, and the lid treated with caustics and the cautery.

On February 19, 1896, the patient first visited this clinic. He had no pain, and he complained only of an annoying feeling of heat and tension, of lachrymation, and of the deformity caused by the greatly swollen and reddened left upper lid. His general health was good, except for a cough of long standing, with expectoration, chiefly in the morning. No cause for the eye trouble was known to the patient. Syphilis was denied.

On examination the right eye was found to be normal. LV = $\frac{6}{6}$. Left upper lid greatly swollen ; the skin reddened and smooth. When the lower lid was everted, in the hyperæmic tarsal conjunctiva were seen two nodules of elongated form, with their apices together, lying parallel to the margin of the lid. They were 3 *mm* long, 1.5 *mm* broad, and 2 *mm* high, with a smooth surface, of a red color, translucent, soft, and suggesting frog-spawn trachoma granulations. Internal to these was a smaller nodule about the size of a pinhead.

Through the upper lid could be felt hard irregular nodules. When everted, there appeared a tumor of dark red color and irregular surface. Nodular formations, elevations suggesting granulations, and pointed condylomata, alternated with superficial and deep ulcers covered with muco-purulent secretion.

Among these were seen white linear or branched scars. The number of these small irregularities with their dark red color, opaqueness, and firmer consistency, was in marked contrast with the changes found in the lower lid. The upper retro-tarsal fold projected as a thick red tumor, while the bulbar conjunctiva exhibits no abnormalities excepting a hyperæmia. The cornea was intact. The iris was normal, and the pupillary reaction prompt. The media were clear, and the fundus normal. On the left temple 1.5 *cm* from the outer commissure of the lids, there was a small red spot with an ulcer at its centre, which had existed for eighteen months. The left preauricular gland was much swollen.

We had to do with a man of medium size, slightly developed musculature, and little panniculus. The color of his face is normal. Nasal breathing is obstructed by a chronic hypertrophic rhinitis. The voice is hoarse, but the larynx is normal, except for hyperæmia of the cords.

The apex of the right lung is somewhat retracted, and dull on percussion. Over the left apex, also, dulness, and fine dry râles. Other organs normal.

A probable diagnosis of tuberculosis of the conjunctiva was made, and examination of the sputum revealed the presence of the tubercle bacillus.

On February 22d the two larger nodules were removed together from the lower lid, as was a large portion of the conjunctiva of the upper lid, and the cutaneous ulcer on the temple. Examination of the parts removed, showed the process to be tuberculous, and it was decided that a radical operation should be done. On March 2d this was undertaken under chloroform. The tarsus of the upper lid was removed, and all diseased portions of the conjunctiva excised. Two weeks later no signs of tuberculosis could be found, the condition of the eye was satisfactory, and the patient's general health was improving under tonic treatment.

In this case conjunctival tuberculosis appeared in consequence of pulmonary tuberculosis. This condition is so rare that only three similar reports can be found in the literature. Hock described such a case in 1875— a physician of sixty-two, with pulmonary tuberculosis, suffered with a deep ulcer of the skin of the upper lid having notched margins, and extending deep into the tarsus. Recovery

followed cauterization with the silver stick. Some weeks later death occurred from the disease of the lungs. The second case was reported by Maren, in 1884,—a boy of six with an affection of the eye that did not yield to treatment and continued over a year, died of phthisis pulmonum. The ulcer of the tarsal conjunctiva with its infiltrated margins, finally destroyed the entire upper conjunctiva, and attacked the tarsus and the lid margin. No surgical treatment was employed.

Wagenmann's patient (1888) had suffered off and on for six years with hæmoptysis, and still had a cough with expectoration. There was found a nodular infiltration of the conjunctiva at the corneal margin, which broke down. After excision and cauterization there was complete recovery. A year later the patient died of his pulmonary affection.

Besides these three cases there are thirteen others reported in which the conjunctival affection was complicated with tuberculosis of other organs. In three of these there was disease of the lachrymal sac, and in six lupus of the face, the eye becoming affected by direct extension, so that only four of the thirteen cases can really be regarded as being due to secondary infection. Opposed to this small number are fifty-two cases of ocular tuberculosis in which no signs of tuberculosis in other organs were found. It is, therefore, natural to regard tuberculosis of the eye as a local disease, and this has been done from the first, Köster in 1873 taking this view.

Just as it is rare in cases of ocular tuberculosis to find tuberculosis in other organs, so in cases of tuberculosis in general it is rare to find ocular complications. Denig examined 250 tuberculous patients, finding choroidal changes in four and conjunctival tuberculosis in none. He proposed to divide cases of ocular tuberculosis into two categories, which also differed as regards prognosis. These were, first, a local tuberculosis in the sense of a primary inoculation of the eye, with but slight tendency to metastasis, corresponding to local tuberculosis of the lungs or bones—the larger class and of more favorable prognosis; and, second, cases of

tuberculosis of the eye which were to be considered "as metastases from a primary focus elsewhere in the body"—a rarer form with a less favorable prognosis.

But our case, and cases of conjunctival tuberculosis in general, cannot be included in either of these categories, since, as Leber and Wagenmann showed as long ago as 1881, conjunctival tuberculosis does not as a rule arise from a metastatic infection through the circulation but from ectogenous infection. In the cases without simultaneous tuberculosis elsewhere in the body the manner of infection is often hard to follow, since the tubercle bacillus cannot be transferred as easily as the diphtheria and other bacilli, and the conditions must be very favorable for its development. In cases in which there is already a focus of tuberculosis elsewhere in the body,—in our case this was in the lung,—which, according to Denig's idea, must be classed in his second category, the supposition that the disease arose through metastasis is much more forced than that of direct infection from without. It is in fact strange that the phthisical who use the same handkerchief for the mouth, nose, and eyes do not often acquire a tuberculosis of the conjunctiva; and this is only due to the fact, which Valude demonstrated experimentally, that the conjunctiva, when its epithelium is intact, possesses in the secretion of tears and the winking of the lids means of protection against the tubercle bacilli even when they are introduced in pure culture into the conjunctival sac.

When these protecting measures are absent or reduced by injury or chronic inflammation, infection easily takes place. Of course there are other means of carrying the infection. Rhein believes the chief cause to be the rubbing of the eyes with the hand, and he finds tuberculosis of the right eye much more frequently than of the left. In our case the left eye was the one affected, but the patient was left-handed. He had also, by scratching the skin of the temple on the same side, brought about a cutaneous tuberculosis at this point.

That tuberculosis of the conjunctiva can arise by external infection in cases of tuberculosis of parts other than the lungs is shown by four cases in the literature. Thus Herter

and Luc each described a case in connection with tuberculous ulcers of the larynx, with multiple ulcers of the skin. Rhein reported a case with tuberculous ulcers of the nose, and Leithold a case with caries of the mastoid after pneumonia and otitis media purulenta.

In these four cases there was a complication on the part of the respiratory tract, but in not a single case was there a tuberculous joint, a tuberculosis of the intestines, or the like, which, in the impossibility of bringing the pus directly into the eye, might be supposed to have given rise to metastatic conjunctivitis.

Therefore it seems fitting to limit the division into local and metastatic ocular tuberculosis to disease of the deeper parts of the eye, such as the iris, choroid, and the like, in which endogenous infection may be assumed to have taken place, corresponding to diseases of the bones and joints; but conjunctival tuberculosis arising from external infection comes into a distinct category.

The prognosis is, of course, worse in cases of simultaneous disease of the respiratory tract, for here it is more difficult to prevent reinfection. The diagnosis must depend upon microscopic examination, for so varying is the clinical picture of conjunctival tuberculosis, and so greatly may it resemble trachoma, syphilis, and even malignant tumors, that a diagnosis from observation alone is difficult. Even in our case there was a certain resemblance to trachoma.

Microscopically, in specimens from the lower lid, I found a marked thickening of the conjunctiva with hypertrophy of the papillæ, and many nodules composed of round cells. Deposited in these nodules were many typical epithelioid tubercles with giant cells and tubercle bacilli. The tuberculous process was limited sharply to the conjunctiva, the glands, the tarsus, and the underlying fibrous tissue being uninvolved. In specimens from the upper lid the process was found to be farther advanced. There had been, apparently, a chronic inflammation of the epithelial elements of the glands with consecutive retention of secretion and cyst formation, and slight infiltration of the surrounding tissues,—changes due to the long-continued inflammation of

the margin of the lid; and besides this, and independent of it, a recent extension of the tuberculous process from the conjunctiva to the chronically inflamed tarsus.

Inoculation tests, as was to have been expected, resulted positively. A bit of a nodule from the lower lid was introduced beneath the skin of the belly in a medium-sized guinea-pig, where, in the course of four weeks, it led to the formation of a large nodule, and swelling of the inguinal glands, in all of which tubercles and tubercle bacilli were found.

As to therapy, palliative measures soon as a positive diagnosis is made. The diseased tissues are to be thoroughly removed, the operation being done in such a way, however, as to avoid as much as possible distortion and deformity from the resulting cicatrices.

In conclusion, I wish to express my thanks to Prof. Schleich for suggesting the subject of this paper, and to Prof. Baumgarten for permission to carry out the microscopic examinations in his institute.

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EXPERIENCES AND STUDIES WITH REGARD TO STRABISMUS.

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Translated by Dr. Matthias Lanckton Foster, New York.

WHEN a physician realizes that the lengthier portion of his life-work is in the past, the question is apt to occur to him how far his own experience has corroborated the instruction upon which he relied when he began practice. At the university we are primarily taught to believe in the words of our teachers; personal conviction of the correctness of that teaching, together with personal wisdom and knowledge, develop gradually from experience. Usually the high estimation with regard to his own executive ability which accompanies the young physician in the beginning of his practice, suffers quite a fall; the ground on which he rests, as he supposed so firmly established, begins to tremble; there comes a time of doubt and uncertainty;—then finally his personal experience gives him a firm ground on which to stand, but only after a part of his cherished ideas have been sacrificed as untenable.

In no other department of ophthalmic work has there been with me such a revolution of conviction as with regard to strabismus and the operations therefor. As I began practice in the spring of 1861, I naturally relied on von Graefe's teaching. If for the present we disregard the true cause of strabismus, it is very remarkable that at its commencement children complain either not at all, or, at most, only temporarily of diplopia. They do not hold their heads obliquely to correspond to the deviation of the eyes, they

have no ocular vertigo, or closure of the eyes to avoid dizziness—in short, children with strabismus behave quite differently from adults who are afflicted with paralysis of one of the muscles of an eye. To explain this difference in the behavior of adults and of children of four years old and under, the convenient theory was advanced that the children forcibly suppressed the image formed in the deviating eye, and that in consequence of this suppression of its image the eye became amblyopic (amblyopia ex anopsia). The natural therapeutic sequence of this theory was that children with strabismus should be operated on at as early a period as possible. Von Graefe says in the *Archiv f. Ophthalmologie*, 1857, No. 2, page 223, that the bringing about of an approximately correct position of the eyes by means of the operation for strabismus is indicated for two reasons: first, in order that the suppressed visual action of the deviating eye may be brought into use again, as this is lessened by eccentricity of the retinal image; and second, because the visual power will be increased, and through these two effects the sensory value of the retinal image will be raised. In a note on page 238, he adds that the maxim to postpone the operation until the intelligence of the child has developed, and the sense of beauty awakened, is wholly wrong. Without the sense of beauty, and without intelligence on the part of the patient, more will be accomplished under all circumstances with tolerably sound muscles and good visual power, than when the latter desiderata are absent. For example, if the uninstructed child has active diplopia, and if the impulse for fusion exists physiologically, far more will be accomplished instinctively to regulate the position of the eyes than in adults under similar circumstances, as they require persistent practice.

This theory that the amblyopia of the deviating eye depends on lack of use is no longer tenable. If it were true, the degree of amblyopia would be proportional to the degree of strabismus, but this is not at all the case; on the contrary we find the highest degree of amblyopia coincident with the beginning of a squint, and a very good acuteness of vision associated with a unilateral strabismus of long standing.

After the strabismus has been corrected, either spontaneously or as the result of an operation, the eye remains just as amblyopic as before; all attempts directed to improvement of the vision of the amblyopic eye have proved disappointing, and therefore there is no reason to expect such an improvement unless the faulty vision may be shown to depend upon an objective, remediable cause. There is at all times an element of uncertainty present when we are wholly dependent on the subjective statements of the patient for the determination of the vision of an eye. In other organs of the body the result of non-use is atrophy, but in spite of long-persistent unilateral strabismus, the so-called amblyopia ex anopsia never results in optic atrophy. All this has been dealt with by A. Graefe (*Graefe und Saemisch*, vol. vi., 1880). Schweigger added the observation that a similar unilateral amblyopia was to be met with among those who did not have strabismus, a form which cannot be called amblyopia ex anopsia, but is known as congenital (Schweigger, *Klinische Untersuchung über das Schielen*, 1881).

There is as yet only negative evidence that the amblyopia of strabismus is congenital; it has not yet been explained why children who begin to squint should behave differently from adults who are attacked with muscular paralysis, particularly when in the latter the affected eye is congenitally amblyopic; and the difficulty has not yet been cleared up as to the explanation of the existence of this unilateral amblyopia where there is or is not strabismus.

Von Graefe's theory of the suppression of the visual image was based on the assumption that the normal binocular single vision of adults is a congenital attribute which results from the normal construction of the eye, but if our present views in regard to the embryological anatomy of the eye are correct this position is untenable. The anatomical structure of the eye alone is congenital, and while it will be readily admitted that the brightest visual impressions come through the macula lutea, the child is obliged to learn to use his eyes in the same way that he has to learn to use his other sensory organs. Herein lies the great difference between the as yet imperfectly developed sight of a child

during the early years of its life up to the time when the strabismus appears, and the perfectly developed sight of an adult. How imperfect the vision of the newly born infant must be may be inferred from the fact that in the eighth fœtal month, when a child is viable in case of a premature birth, the entire visual tract, from the eye to the transcortical system of association fibres, consists only of axis cylinders without medullary sheaths, and there is, therefore, no possibility as yet of an isolated conductibility on the part of these nerve fibres; together with the fact that at the time of birth the formation of medullary sheaths has begun in the optic nerve, but requires some months to extend in a centripetal direction from the periphery until completed in the transcortical area,—according to Fleichsig, at about the end of the tenth month. Before the expiration of this time, correct visual perceptions on the part of the child are altogether impossible, for they are brought about through the connection between the visual centre in the gray cortex of the occipital lobe and the centres of all the other organs of sense, the motor centres of the muscles of the eye, the motor speech centres, the motor centres of the limbs, especially the motor centre for the right hand,—the centres, in short, of all the motor and sensory parts of the body. The true appreciation of space, as well as of the form and color of the objects seen, is obtained through the mutually correspondent activity of all the transcortical systems of association fibres—that is, through the association in the cortex of the occipital lobe between the visual impression of a certain object and the impression made by the same object upon the other centres of the organs of sense and the motor centres; in other words, the child attains the conscious use of his eyes in accordance with reason at the same time that he attains the like use of the other organs of special sense. While one child will be more forward than another, just as in learning to speak, about four years of its life will elapse before the intricate nervous tracts are anatomically completed, and their use thoroughly learned. It cannot be that the newly born infant receives anything more than an indistinct impression of light and dark, for it has no knowledge of space, form,

or color. Gradually, in association with the anatomical development and the functional exercise of the nervous tract, visual perception and finally visual appreciation are developed. Baumgarten was right when he suggested, in 1840 or 1841, that an infant during the first few weeks of life perceived only a quantitative impression of light, although von Graefe pronounced him in error. Baumgarten's error was in the explanation which he advanced to account for his correct observation,—that the macula lutea was developed after birth; while the true cause is to be found in the medullary sheaths in the optic nerve. That normal binocular fixation is not a faculty given man at his birth (in accordance with the nativistic theory), but is an attribute which must be acquired by long experience and study (the empirical theory), is supported by the testimony of every patient who, blind from birth or from early childhood from cataract, has had this removed at a period of life when, in consequence of the development of the understanding, reliable information can be obtained as to the impressions made by the pictures of the outer world which for the first time fall unhindered on the retina. These patients need to touch objects to gain a knowledge and understanding of them; they are very uncertain in their estimates of distances and of movements; they do not correctly recognize colors, and they are also in a condition of psychical blindness,—which demonstrates that the use of all the associated nervous tracts of the visual centre, which is necessary for perfectly intelligent vision, has not yet been learned. This condition of psychical blindness, or sensory anopsia, might be denominated a physiological form to distinguish it from the pathological form which is occasioned by interference with the functional activity of the same nervous tracts by a pathological lesion. So even if it should be granted that the medullary sheaths are all formed in the region of the visual centre in a child at the time of its birth, and that thus an acute perception of the objects in the outer world is possible, the child would still be in a condition of physiological psychical blindness, and must remain so until, by the help of its other senses and its organs of motion, it has obtained

a correct understanding of the images formed on its retinas, in other words, until it has learned the intelligent use of its eyes and of its sensory organs in general. Although the testimony of persons born blind and operated on in adult life has been known since the publication of Cheselden's frequently quoted case (*Philosophical Transactions*, 1728, page 447), von Graefe did not take this and the inferences to be deduced from this in regard to the development of the normal act of vision in children into account when he propounded his theory of the suppression of the vision of the deviating eye in strabismus. How slightly the knowledge of how to see, learned prior to the age of four years is established, can be shown by those cases in which, with no pathological lesion in the eyes, there existed for months an apparent blindness on account of blepharospasm. The first observation of this nature was made by von Graefe, who believed the bad vision was the result of pressure, as in glaucoma. This explanation was accepted by R. Schirmer, on the occasion of his publication of two other cases, but Th. Leber did not accept it, because there were no appearances of a glaucomatous condition, and he was the first to correctly perceive that we have to deal here with a relearning of the act of vision, analogous to the learning again of speech by children who have lost their hearing before the acquired command of language was firmly established, an opinion with which Samelsohn coincided. There are only seven cases of such children under the age of four years recorded, though many more must have occurred, but this is not surprising, as the condition is one which, of itself, is unimportant, the patients recover of themselves, and the observations are of no practical, though of great scientific, value. What the child learned before the attack it soon learns again after the removal of the blepharospasm, for the condition is not one of true blindness, but of a retrogression into the psychical blindness normally present in every child before it has learned to see. If the knowledge of how to see has been thoroughly acquired, as in adults, then a long closure of the eyes does not result in a state of psychical blindness any more than an adult loses the power

of speech through deafness. The difference between the visual condition of an eye which has been blinded for some time during the early years of life by blepharospasm and that of an eye from which a congenital cataract has been removed in adult life is only that in the one case it is the taking up again of an interrupted and more or less forgotten study, while in the other it is the actual commencement of the same study, but in neither case is true blindness, or amblyopia, produced. The fact is then that prevention of the use of congenitally normal eyes cannot produce true blindness, but only a condition of psychical blindness which will gradually disappear after the hindrance to the use of the eyes is removed, a fact which does not agree well with the theory of amblyopia ex anopsia. It is impossible to suppress a sensory organ, for man can suppress only an activity which is under the control of the will, and the sensory organs are not under such control. The use of these organs is unconsciously and involuntarily self-taught to the child, just as the familiar sounds of the mother tongue are learned, independently of the will. The beginning, as well as the highest possible functional development, of the sensory organs in animal organisms, depends on the excitation of the senses by external objects, and so does the development of the eye depend upon its excitation by the rays of light. Animals which live wholly in the dark do not have their eyes developed, and when animals of a race formerly accustomed to live in the light and to use their eyes become dwellers in the dark their eyes gradually become rudimentary or disappear. The excitation of light is sufficient to develop the functional activity of the eye; under its influence the formation of the medullary sheaths gradually extends in the optic nerve from the periphery, and its forcing influence is such that the formation of the medullary sheaths takes place so rapidly in a child born in the eighth fœtal month that at the end of a month the process is further advanced than it is in a child born at full term. From the foregoing it seems to me that the theory that the unilateral amblyopia of the deviating eye in strabismus is an amblyopia ex anopsia, and results from suppression of the normal visual act,

is an embryologico-anatomical chimæra. The amblyopia can only be congenital; the fact that children who begin to squint do not suffer from diplopia as do adults is a proof that binocular single vision has either not been learned by them at all, or, if they have temporary diplopia, been developed so imperfectly that it should be forthwith learned again. The final cause of all cases of strabismus must be absent or imperfectly learned binocular single vision, so that binocular fixation, instead of passing over into binocular single vision is lost under the influence of the strength of the extrinsic muscles. When binocular single vision is absent an eye may have normal vision and yet deviate, but when it is well developed, even though the vision is congenitally poor, there will never be strabismus. Of course unilateral bad vision, from astigmatism, corneal opacities, unlike refraction in the two eyes, or a high degree of hypermetropia with the accompanying tax on the accommodation, favors the imperfect development of binocular single vision, and therefore the beginning of strabismus, but it is not the exciting cause of the latter, for all of these conditions may be present and yet there be no strabismus, because binocular single vision has been developed.

The relation of corresponding points in the retina normally associated with binocular single vision is equally as little a congenital condition, it also is learned and developed during life. If a child four years old begins to squint because binocular single vision has been learned either imperfectly or not at all, there can be no normal relation of corresponding points in the two retinas, for the latter certainly results from a normally learned binocular act of vision. But the learning to see is not completed when the strabismus begins, the child continues to learn in spite of it, and because only thus can it learn to localize correctly the objects seen, there comes about a certain localization of images on the retina of the deviating eye, to the extent to which it can be brought into use, which does not agree with the relation of corresponding points of normal fixation and normal binocular single vision. As the result of the strabismus a quite abnormal relation of corresponding points is developed, in-

congruence of the retina, an event just as comprehensible as the development of the so-called normal relation of corresponding points in the non-strabismic eye, because the relation of corresponding points in our retinas is not a congenital attribute of the eyes, but is learned and developed during life. A. Graefe in his latest work takes a similar ground with regard to the development of the relation of the corresponding points in our retinas, but in regard to normal binocular single vision he adheres remarkably to the idea that this is a congenital attribute, and to the theory that the non-appearance of diplopia in strabismus is due to the suppression, or exclusion, of the image formed on the retina of the deviating eye. He arrives at the singular conclusion that a person with strabismus has single vision for two reasons, because of the suppression of the image in the deviating eye, and because of the incongruence of the retina. The disturbance of binocular single vision in a person with strabismus, he says, depends upon exclusion, or on a formation of new relations of corresponding points, or in a combination of both of these events, and the individually different degrees of perfection of these two conditions, together with the particular form of their combination, occasion the varying manifestations of that disturbance. If, as I believe, the normal binocular single vision and the closely connected relation of corresponding points are not congenital, but are learned and developed attributes of our eyes, there is only one cause for single vision in strabismus and I may thus formulate the proposition: The lack of binocular single vision in strabismus, as well as the formation of incorrect relations of corresponding points, depends upon a failure to acquire, or a defective acquisition of, the act of vision in both eyes during the first few years of life. The varying manifestations depend upon the individually different degree of defect in this acquisition.

Not only are normal binocular vision and the associated relation of corresponding points in the retinas developed after birth, but the co-ordinated movements of the eyes and of the lids, whether associated, accommodative, or both combined, are also not congenital. This has been determined by W. Preyer (*Die Seele des Kindes*, Leipzig, Th.

Grieber's Verlag), who made daily observations on his own child from its birth until the end of its third year. According to his observations the movements of the lids in the newly born infant are quite lacking in symmetry. One eye may remain open while the other is closed and when both are open they are during the first month apt to be unequally so; at this time too the lids may be raised when the eye is looking downward, and then may not accompany the motion when the eye looks upward, so it appears that the separate nerve branches which originate within the oculomotorius region can be innervated independently of each other. Reflex closure of the eyes and contraction of the pupil on account of strong light is congenital, but the reflex closure of the eyes on the approach of objects near them appears first during the third month. Regarding the movements of the eyes, Preyer says: Close and repeated observations of the movements of the eyes taught me that particularly during the first six days the turning of the eyes to the right or the left is not co-ordinated as symmetrically as in adults. Repeatedly I saw in a child whose eyes were wide open purely associated movements which a careful examination showed to be not exactly alike. I found that often one eye moves independently of the other and that the head is turned in the opposite direction to the movements of the eyes, so that it is quite evident that both movements are without aim and that the coincidence of the two in the early days of life is accidental. The movements of both eyes to the right or the left at this time also appear to be accidental, because they only form a part of all possible movements of the eyes. The ability to converge is very marked during these early years, and the movements of the eyes finally become well co-ordinated after the lapse of four years. In closing, Preyer says: All of these observations favor the theory that the conscious act of vision is for the regulation of the movements of the eyes; that after the penetration of the impression of light to the visual centre a harmonious motor impulse proceeds from the centre to the three nerves which supply the muscles of the eyes, and that at first, while the eye has only the power of receiving light, but not as yet

that of vision, its movements are not associated or co-ordinated. Even if they are found to be symmetrical the great number of atypical movements of the eye immediately exclude the idea of a bilaterally symmetrical nervous mechanism ready to perform its functions at birth. For if man, like chickens and some other animals, brings such a mechanism into the world with him, why must he perform with his eyes so many objectless movements before he can get the full use of that mechanism? It is self-evident that a hereditary tendency to this condition can be easily proven. The common rule that the movements of the muscles of the body become gradually co-ordinated is also true of the muscles of the eye. There is then no preformed organism which from the beginning occasions co-ordinated and symmetrical movements of the eye. Raehlmann, Witkowski, and Schoeler have come to similar conclusions. A newly born infant is unable to fix its gaze on a bright object because fixation is an act of the will, but the infant is at first without will or understanding and is therefore unable to move the eyes in accordance therewith. It stares into space with a stupid expression of countenance, and appears to fix its gaze only when an object is brought into its line of vision, but when that object is removed the position of the eye does not change. Neither can the newly born infant accommodate voluntarily. Although in adults with normally developed binocular single vision both eyes readily accommodate, yet while the child is learning to see it accommodates imperfectly and unequally, otherwise it cannot be explained how, when both eyes are originally in an equally hypermetropic condition, one should become myopic while the other remains hypermetropic, or becomes emmetropic or to a far less degree myopic. Again the occurrence of unilateral congenital paralysis of the abducens proves the possibility of unequal innervation of the muscles of the two eyes during the earliest childhood; the eyes are parallel, convergence is normal, a single lateral motion is produced by the action of the internus of the unaffected eye, and there is no secondary contracture, such as is met with in cases of acquired paralysis. From what has been said it is

evident that for the elucidation of the functional troubles which develop in the eyes of young children we should not trust to the guidance of the already developed functions of the eyes in adults, but should first of all determine the development of that normal physiological condition; we must trace this embryologically and understand it thoroughly before we can correctly recognize and explain deviations therefrom in children, otherwise we will be greatly in error. No matter how cleverly a scientific theory is built up, it becomes untenable as soon as the grounds upon which it is based are shown to be erroneous. A violent suppression of the visual image and a resultant amblyopia ex anopsia does not exist and so far as the teaching in regard to strabismus and its operative treatment is based upon this theory it is wrong.

It cannot be denied that the untenableness of the theory in regard to amblyopia ex anopsia in one eye has created new difficulties for scientific solution. Whence comes this congenital amblyopia, and how is the complete absence of any pathological change in the fundus to be explained? The origin of a marked unilateral amblyopia must be situated peripheral in the chiasm. It is highly improbable that one optic nerve should be developed normally and that the other should not be in the same individual. The amblyopia must originate from a cause situated outside of the optic nerve and the retina which destroyed or retarded the development either before or during the birth of the child. Some light is cast upon this subject by the works of J. Königstein, Bjerrum, and particularly Schleich. The latter by a careful ophthalmoscopic examination found in the eyes of 150 newly born infants the following pathological conditions:

a. In five children (3.3 %) abnormally pale coloring of the sheath of the optic nerve, together with a marked thinness of the blood-vessels.

b. In one child (0.7 %) considerable infiltration of the sheath of the optic nerve and its neighborhood, arteries normal, veins much enlarged, diagnosis choked disk.

c. With extraordinary frequency retinal hemorrhages, 78 times in 49 children (32 %), that is, in both eyes of 29, and in one eye alone of 20 children.

All possible forms and sizes of hemorrhages were found. They all appeared quite fresh and as if occasioned during the act of parturition, while their absorption took place very rapidly, usually in a few days. In 1890 M. Naumoff published a paper on "certain pathologico-anatomical conditions in the fundus of new-born children" (*Archiv f. Ophthal.*, xxxvi., 3, p. 180). He had examined the eyes of 47 infants born at full term, which had died either during birth or shortly afterward, and had found pathological conditions in 12 pairs of eyes (25.5 %). In addition to these he had examined the eyes of 22 prematurely born children, 10 of the seventh fœtal month and 12 of the eighth fœtal month, but found among them no pathological changes, although Königstein did find changes in the eyes of such children also. The pathological conditions which Naumoff describes consisted in two cases of choked disk, and in all the others of hemorrhages. The latter had occurred twice in the sheath of the optic nerve, three times in the choroid, and in all the rest of the cases in the different layers of the retina. These hemorrhages had occasionally happened through diapedesis, but usually through rupture of capillaries during parturition. He ascribed as the usual cause of the choked disks and retinal hemorrhages the increase of intracranial pressure during labor by compression of the bones of the skull and of their contents, while vascular engorgement might be held to explain the presence of hemorrhages in various other parts of the eye, such as the choroid and conjunctiva. Naumoff attempted to show the relation of the pathological conditions described by him to the details of labor, and found that, although no particular influence appeared to be exercised by the various presentations of the fœtus, or by operative measures undertaken to expedite the labor, yet a narrow pelvis and a prolonged duration of labor appeared to be essential factors in the production of these pathological conditions. His conclusions are as follows:

1. Changes in the eyes of the newly born are found not only after labors which are in certain respects abnormal, but also after those in which the course has been normal.

2. Children of mothers who have narrow pelves show

pathological changes in the eyes more frequently than those whose mothers have normal pelves.

3. The occurrence of the pathological changes in the eyes of the newly born stands in relation with the duration of labor, no matter what may occasion its prolongation.

4. Such changes occur more frequently in the first-born than in succeeding children, because of the longer duration of labor in primiparæ.

There can be no doubt that these retinal hemorrhages are not without influence on the later function of the eye. If they are small and associated with no considerable change in the structure of the retinal tissue, they may leave behind no appreciable trace, especially if they are situated in the periphery of the retina, but if they have caused destruction of the retinal tissue it may, particularly if the region of the macula is involved, leave behind amblyopia in spite of the fact that they disappear so completely that no lesion can be found with the ophthalmoscope. Amblyopia caused in this manner may be either monolateral or bilateral. Bloch (*Centralblatt f. praktische Augenheilkunde*, xv., p. 134) found among about 116,000 patients seen in Hirschberg's eye clinic at Berlin between the years 1869 and 1890, 438 cases of paralysis of the abducens, 31 of which were congenital. Three of these were shown to be in consequence of a difficult delivery with forceps, while for the others no explanation was given. Why a troublesome diplopia was not observed in any of these cases has already been considered. It has long been known that, aside from the graver injuries, such as contusions and lacerations of the lids, contusions or luxations of the globe, traumatic exophthalmus, fractures of the orbital arch on one or both sides, and fractures of the base of the skull involving the orbit, there may occur such injuries as contusions and lacerations of the optic, abducens, trochlear and facial nerves, laceration of the ophthalmic artery or vein, and lacerations of the muscles of the eyes, but it is of great and practical importance to emphasize the fact that such severe injuries can occur when forceps have not been used if the head of the child is severely compressed by the bones of the pelvis, when the outlet is too small, either

on account of its natural size, or from the presence of an exostosis. Not infrequently an autopsy on a still-born child reveals intracranial hemorrhages. A normal labor certainly gives no guarantee that an injury may not have occurred to one or both optic nerves sufficient to cause an amblyopia which would be designated congenital, although occasioned by an injury during parturition. If such an injury should occur to the optic nerve above the entrance of the vessels an ophthalmoscopic examination after birth would reveal no lesions, and hemorrhages into the retina would quickly disappear, leaving no observable trace, except it may be such an amblyopic disturbance as a central scotoma, in which case the eye will fix excentrically, a condition not infrequently met with in strabismus, where as a rule we have a congenital amblyopia with no observable lesion in the fundus, a normal field of vision, normal color sense, and an unchangeable visual defect. A source of trouble which should not be undervalued may appear in the asymmetrical development of the bones which form the base of the skull, especially of the sphenoid, as abnormalities of the optic foramen or canal must interfere with the development of the optic nerve. I can quote from my own practice a family in which there are two daughters who show a very marked asymmetry of the bony parts of the two sides of the face, so that one side of the face is much smaller than the other. In both cases the eye on the undeveloped side of the face is amblyopic, in one girl to a low degree and associated with strabismus, in the other to a very high degree without true strabismus, although the conformation of the orbit is such as apparently to produce it. In both of these cases it seems certain that the abnormal development of the bones of the skull interfered with the normal development of the involved optic nerve and resulted in characteristic congenital amblyopia with nothing abnormal to be seen in the fundus. These are two extreme cases, but smaller, or less marked, abnormalities appear in the development of the two sides of the skull very frequently. To what degree rickets, scrofula, or congenital syphilis may be causative factors I do not know. The reason why no ophthalmoscopic changes can be observed

in a case of congenital amblyopia occasioned by interference with the development of the optic nerve must be that the injury to the nerve took place at a time when it was not completely developed, that is, when it was composed for the most part of axis cylinders without medullary sheaths, the formation of which afterward advanced quietly in its normal course. In adults the course of events is quite different, because an adult does not possess the same regenerative power that is present at the time of development.

Inasmuch as the acuteness of vision cannot be improved by the correction of the strabismus there is no reason to hasten the performance of an operation, the only effect of which can be to improve the cosmetic appearance, and even this, as a rule, imperfectly on account of the absence of binocular single vision which induces and preserves the correct position of the eyes. In spite of the above-quoted opinion of von Graefe, the best results will be obtained after the intelligence of the patient has developed sufficiently to be of assistance in the treatment. Unfortunately also the operation for strabismus is associated with the production of some little cosmetic defects, such as the sinking of the caruncle and protrusion of the eyeball, and, in order to avoid a production of these defects to too great a degree, a slight remnant of the strabismus is frequently left behind. The most ideal correction of strabismus which I have seen, is that which takes place spontaneously without operation, and I am therefore of the opinion that no case of strabismus should be subjected to an operation until after every hope of obtaining a spontaneous correction by means of wearing the proper glasses to correct the refractive error and of exercise of the weaker antagonist has been exhausted. Whether binocular single vision, which has never been present, or has been only slightly developed, can be permanently learned by means of stereoscopic exercise, or not, I do not know, but it certainly would require such persevering practice for a number of years that it is seldom if ever practicable. No operation should ever be performed before the refractive condition has been determined, for strabismus may be recovered from spontaneously even at the age of twelve or six-

teen years. Not alone the refraction but also the conditions of the extrinsic muscles change with the lapse of years, and the eye of a child who squints on account of an acquired corneal opacity will turn in, while that of an adult with unilateral cataract will turn out, an evidence that with improvement in refraction and increase of age the former preponderance of strength in favor of the interni passes over to the externi. The earlier the period at which a surgeon operates the more certainly will he be disagreeably surprised by the presence of a horrible over-correction, if he should meet with the patient again in after years. The effect of the same operation differs in different individuals on account of the variation in the power with which the antagonist draws the eye over to its side, a power which cannot be previously determined. Von Graefe deplored the uncertainty of judgment in regard to the immediate effect of the operation when performed under chloroform narcosis, but what is there to-day to prevent us from delaying the operation until the patient has become sufficiently intelligent to enable us to obtain a more exact examination and to operate under cocaine alone? The earlier the operation the more uncertain will be the final result.

ABSTRACTS OF THE PAPERS IN VOL. XXXIII. (1896) OF THE GERMAN EDITION OF THESE ARCHIVES NOT PREVIOUSLY TRANSLATED.

By Dr. COLMAN W. CUTLER.

I.[1]—Antisepsis or Asepsis in Operations on the Eyeball. A Comparative Bacteriological Study.

By Dr. **LUDWIG BACH**, Wurzburg.

During the past months, I have used irrigation and at the same time mechanical cleansing of the edges of the lids and of the conjunctival sac with 1–3000 bichloride solution; as the process has been the same as that which I used in the experiments with physiological salt solution, the results provide the means of estimating the relative values of an antiseptic and an aseptic method. The conjunctival sac and the edges of the lids were wiped with cotton wet with 1–3000 bichloride and irrigated at the same time. The results of twenty-five experiments carried out with bichloride are compared with a series of cases which were treated with salt solution alone. The following table shows the results:

Mechanical Cleansing with Irrigation	With antisepsis.	With asepsis.
showed a diminution of the bacteria on the edges of the lids in	44 %	42 %
showed a diminution of the bacteria in conjunctival sac in	44 %	30 %
" sterility of the edges of the lids in	56 %	50 %
" " " " conjunctival sac in	40 %	40 %
An apparent increase of bacteria in the conjunctival sac was produced by mechanical cleansing in	16 %	5 %

[1] The numbers correspond to those of the German edition.

Franke found that with a simple irrigation of the conjunctival sac with antiseptics there was a diminution of bacteria in 24 % and sterility of the conjunctival sac in 0.75 %.

By these experiments it is proven that much more is accomplished by mechanical cleansing with irrigation than by mere irrigation. The comparison shows also that the results are about the same with antisepsis and asepsis. Since there is no advantage to be gained in the use of antiseptics and the solutions in sufficient strength to destroy the bacteria are more or less irritating, their use must be advised against both from a bacteriological and a clinical standpoint.

II.—Concerning the Danger of Infection in Different Operations on the Eye, and the Conditions Affecting the Progress of Suppuration from its Anterior to its Deeper Portions.

By Dr. **N. ANDOGSKY**, St. Petersburg.

The paper is divided into three parts: 1. Injection of india ink into the anterior chamber of rabbits after different operations, to determine what influence the altered currents of the ocular fluids might have on the diffusion of the injected substances. 2. Examination of the aqueous, lens matter, and vitreous to determine their qualities as culture media, especially for the staphylococcus pyogenes aureus. 3. The performance of different operations on the eyes of rabbits, followed by inoculation of the eyes with pyogenic cocci, with clinical observation of the results and careful pathological examination.

Under the first head experiments gave the following results: The removal of india ink from the anterior chamber of the normal eye takes place through the spaces of Fontana. The granules may pass through the ciliary body and reach the supra-choroidal space; some are taken up and held by the cells on Descemet's membrane. In the normal eye india ink never passes from the anterior chamber to the vitreous. When injected into the vitreous, it passes in part into the lymph spaces of the optic nerve, but mostly

forward through the zonula of Zinn into the anterior chamber.

After iridectomy or discission, and, in fact, whenever the posterior capsule of the lens and the zonula of Zinn are intact, the course of the india ink remains the same. If the posterior capsule is perforated after extraction of the lens, the current is reversed and the greater part of the ink passes backward through the vitreous in a manner suggesting the existence of a series of funnels converging toward the optic nerve.

Staphylococcus aureus was used to inoculate tubes containing aqueous, aqueous containing fragments of lens matter, and vitreous, and it was found that the mixture of lens matter with aqueous formed by far the most favorable medium for the development of the cocci. This may be explained by the high percentage of albumin in the lens. Aqueous alone delayed the development of the cocci six to nine hours, and probably in the anterior chamber where it is constantly renewed it would be still more effective; and in fact the examination showed that in the normal anterior chamber staphylococci in the quantity of 0.05 *cc* of a bouillon culture did not increase. Such an injection produced an iridocyclitis with fibrino-purulent exudation, which reached its height in two days, then gradually diminished without spreading to other parts. The organisms are removed from the anterior chamber by phagocytosis and with the exudation, through Fontana's space, but they do not reach the supra-choroidal space nor do they pass into the vitreous if the posterior capsule and zonula are intact.

After discission of the lens, the infection with very small quantities of cocci produces invariably panophthalmitis, since the microbes increase very rapidly in the lens substance. The process makes rapid progress, especially if the posterior capsule is wounded so that they can pass into the vitreous. The same is true after cataract extraction. It has been mentioned that india ink after entering the vitreous penetrates the lymph spaces of the optic nerve; cocci never enter the tissue of the nerve, but are intercepted before reaching its surface by a mass of leucocytes; the

retina and choroid, however, are speedily infiltrated with the purulent exudation. The exemption of the optic nerve is true only when cocci enter the vitreous from the anterior chamber, and not if they are introduced farther back in the vitreous, so that the observation does not militate against Deutschmann's migration theory of sympathetic ophthalmia. Small quantities of a diluted culture of staphylococci injected into an eye from which all remains of the lens have been removed, cause only a mild exudative iritis, even if the posterior capsule is perforated. It is therefore obvious that the presence of the lens substance is of the greatest importance in the development of suppuration.

IV.—The Amblyopia Associated with Strabismus.

By Dr. **GUILLERY**, Cologne.

I have endeavored by the study of the field of vision to throw new light on the question of amblyopia, and have examined the periphery of eyes with strabismus and amblyopia in a manner best adapted to solve the question. Nearly five years ago I recommended the use of a single point for testing the vision, and defended it against the old prejudice that in this manner the light sense, and not the vision, was tested.[1] Recently Groenouw has made use of the same method for the periphery, and has accomplished much more than with colored squares.[2] Groenouw determined the average distance from the centre at which points from $\frac{1}{4}$ *mm* to 4 *mm* diameter were seen by the normal eye, and called these limits isopters. These were almost exactly parallel to the outer limits of the field.

In the present instance, as in my visual tests, each point is placed in different corners of a quadrangle, so that the patient must state where he sees it; this makes the limits narrower than in Groenouw's test, but adds to the accuracy.

The examinations of five cases are given which show central and peripheral amblyopia bearing no typical relation to each other. When peripheral vision was diminished the

[1] These Archives, German edition, xxiii., 3 and 4, and xxvi., 1.
[2] These Archives, German edition, xxvi., 2.

amblyopia was uniformly distributed over the field; not infrequently, however, central vision was diminished and the function of the periphery normal.

These results are not favorable to the theory of amblyopia from disuse. We know of no influence which would act on both centre and periphery and yet affect them so differently. The causes of amblyopia in strabismic eyes are surely manifold, and it seems vain to attempt to explain the condition from any one standpoint.

V.—Is Intermarriage a Factor in the Causation of Pernicious Myopia?

By Dr. **JULIUS WOLFF**, Cologne.

Among 126 patients with myopia of 9 D or more, and with secondary changes and more or less diminished vision, 13 were found whose parents were related. This proportion of 10 per cent. leads the author to conclude that pernicious myopia may be dependent on intermarriage, and that this factor, while not the most important, is the only one established.

VI.—Report of 295 Cataract Operations in Prof. Schöler's Clinic, Berlin.

By Dr. **WALTER ALBRAND**, Berlin.

This is a continuation of a report published in these Archives, vol. xxvi. of the German edition.

In the period here reported, from 1892–1895, 144 extractions with iridectomy showed the following results:

V	15/15	15/20	15/30	15/40	15/50	15/70	15/100	15/200	Fingers counted at					V not tested	V=0
									15′	10′	5′	3′	1′		
Cases	3	6	17	19	27	17	23	14	1	4	1	1	3	1	7

Five eyes were lost through suppuration; in 7 there was loss of vitreous; in 7 cases the operation was followed by severe inflammation of the uveal tract.

One hundred and fifty-one extractions without iridectomy are tabulated as to their vision thus:

V	$\frac{15}{15}$	$\frac{15}{20}$	$\frac{15}{30}$	$\frac{15}{40}$	$\frac{15}{50}$	$\frac{15}{70}$	$\frac{15}{100}$	$\frac{15}{200}$	Fingers counted at 15′	10′	3′	1′	V not tested	V = o
CASES	7	6	14	26	16	17	31	15	5	3	1	1	3	6

Suppuration occurred in 2 cases; loss of vitreous in 6; in 3 of these cases $\frac{1}{4}$ of the normal vitreous escaped, but V was ultimately $\frac{15}{40}$, $\frac{15}{100}$, and $\frac{15}{60}$. Severe inflammation of the uveal tract occurred 12 times during the after-treatment, aside from wound infection, one of these being followed by sympathetic ophthalmia. In this case the iris prolapsed on the fourth day, and, while not protruding, it filled the entire wound. Iridectomy downwards and in the fourth week discission of secondary cataract gave V of $\frac{15}{50}$. After 2 weeks, sympathetic ophthalmia of the other eye appeared and vision of $\frac{1}{2}$ remained after prompt enucleation of the exciting eye. The hardly perceptible iridochoroiditis was undoubtedly due to infection of the incarcerated iris.

In one case after extraction with discission in the fourth week, glaucoma made its appearance suddenly, 3 weeks later. This was relieved by repeated puncture, with V = $\frac{15}{30}$.

Prolapse of the iris took place 10 times.

Because of a series of cases, which seemed to accompany the simple extraction, of severe iridocyclitis with hypopyon, occurring in a period of several months, without infection of the corneal wound and from 8 to 14 days after the operation, the tendency has been to return to extraction with iridectomy.

VII.—A Case of Paralysis of the Trigeminus.

By Dr. **J. K. A. WERTHEIM SALOMONSON** and Dr. **C. H. A. WESTHOFF**, Amsterdam.

Isaac K., æt. 54, suffered from December, 1894, with bilateral frontal headache. At first the pain was boring and throbbing, but gradually diminished. At the end of March he had a feeling of icy coldness in the right side of his face which has lasted

since then. In February, for some time, he had tinnitus. Since April he has had frequent nosebleed from the right nostril and the ala nasi on this side is somewhat swollen. Since March he has been able to chew well only on the left side. During the last of April the right eye became inflamed and vision diminished on that side.

There is nothing notable in the family history. He contracted syphilis thirty years previously and has suffered since then at intervals with tertiary manifestations. Present condition: Well-built man, slightly bent, tortuous temporals, numerous scars on legs and elsewhere more or less recent. The right conjunctiva bulbi is much injected and shows numerous vessels, coursing for the most part radially. A ring, 2 *mm* broad, of transparent pellicle, extends from the limbus towards the centre of the cornea; it contains no blood-vessels, and the inner margin may be raised a little with a probe. The epithelium of the centre of the cornea is intact, but there is a diffuse interstitial opacity. The eye is normally moist. Cornea and conjunctiva are anæsthetic, motility normal. The pupil reacts to atropine. Tn. V = $\frac{3}{60}$. O.S., V = $\frac{6}{6}$. Ophthalmoscopic examination and field normal. The right ala nasi is swollen, infiltrated, and dark red; on its inner side are several rhagades covered with crusts. Sense of smell somewhat depressed. The area of the right trigeminus is entirely anæsthetic for touch, temperature, and pain; the motor portion of the nerve is also paralyzed. The electrical examination shows reaction of degeneration in the right temporal, masseter, and digastric. Slight paresis of right facial. The right palatoglossal arch is higher than the left and the uvula deflected to the right. Larynx normal. Taste is lost over the right anterior two thirds of the tongue. The right facial reflex absent, other reflexes normal.

Under continued mixed treatment and mild bichloride collyrium, the hypertrophic margin of the cornea gradually disappeared, but the interstitial opacity remained. Towards the end of May sensation for temperature improved slightly, but was again lost. Gradually bulbar symptoms appeared, followed by unconsciousness and death. No autopsy.

Among recent investigators Gaule has thrown some light on the subject of neuro-paralytic keratitis. He repeated Claude Bernard's experiments and proved that only

when the trigeminus was divided at the Gasserian ganglion, or peripherally from it, was it followed by keratitis. Also in partial lesions of the ganglion there was usually keratitis, and in these cases there was found to be an intense neuritis. Turner concludes that there is no proof of the existence of a trophic influence of the trigeminus, and that irritative processes in the nerves are essential. From the recent investigations of Gaule, Gastell, Winkler, Samuel, and others, it would seem that the trophic influence of the nerve cell is nothing specific, but merely a variety of its normal function, and is inseparable from this. The dystrophy which takes place with a loss of life is for the most part a sign of the irritability of dying fibres. When keratitis neuro-paralytica occurs, we must assume that there has been an excitation of the nerve stump which may suffice to cause keratitis even if conduction is not interrupted.

In this case there was no ulceration of the cornea, but a marked hypertrophy of the conjunctiva extending as a broad, smooth ring over the cornea. The ulcerations and infiltration about the nose were tertiary syphilitic in character, but altered by the morbid nerve influence. Snellen's experiments show that there is something needed for the development of neuro-paralytic keratitis besides failure of normal innervation. The exciting causes are numerous; the cornea becomes the point of least resistance. Sensitive nerves are probably anabolic in their action. In the course of skin lesions following neuritis, the changes are at first in the direction of overproduction; there is thickening, and, through the process of excitation, the formation of new layers of epithelium takes place, to be followed later by atrophy and thinning when the nerve cells are dead.

XI.—Analysis of the Process of Touching Objects Looked at.

By Dr. **MORITZ SACHS**, Vienna.

I.

In the simplest form of the test of the localizing function or projection, the patient is asked to touch an object quickly

with the previously concealed finger. The object must be seen and must remain fixed. The localization of a visual sensation is given by the situation of the stimulated part of the retina; and certain disturbances in projection may be attributed to disturbances of perception and in the formation of the image, such as opacities, which deflect or scatter the light, or to diminished sensitiveness of the retina in different parts. These factors may be detected by a careful examination of the media and of the field of vision. If this is accepted, there is no place left for the assumption that the localizing power of the retina can be affected primarily as such. In a case described by Exner, the patient felt for the candle flame, as it were, with his eyes, in certain parts of the field, and was unable to localize it, although he was aware when it was covered or exposed. This was undoubtedly due to a diminished sensitiveness of the retina in those parts, which enabled other portions reached only by diffused light to vie in functional activity with those directly in line with the light.

II.

The second point is the influence which the muscular apparatus exerts on localization. In the normal eye "the effort to see an object as clearly as possible, combined with a perception or idea of its position relative to the object just under observation, controls the movements of the eyes."[1] The result of a disturbance of motility is that the usual degree of innervation is not enough to bring the object toward which the attention is directed to the centre of the retina. If the right abducens is paralyzed, and a red glass is placed before the right eye, when a light is held in the sphere of the paralyzed muscle, the red light will appear to the right, and in an attempt to touch the red light, the finger would of course pass to the right of the candle. The red flame is seen to the right of the fixed white flame because the flame forms its image in the right eye on a spot to the left (inwards) from the macula, and because of the

[1] Hering, *Die Lehre vom binocularen Sehen*, 1868, p. 23.

projection belonging to this spot its image is referred farther to the right than that of the normally fixing left eye. The case, observed in this way, is interesting because it is in opposition to a wide-spread idea that in the use of the projection test in cases of paralysis, it is not necessary that the paralyzed eye should intend to see the object in order that the false localization be brought out. If the patient fixes the red light belonging to the paralyzed eye, and attempts to touch it, he will reach still farther to the right than in the first experiment.

With the fixation of the paralyzed eye, the secondary deviation of the healthy eye becomes greater than the primary deviation of the paralyzed eye. This is due to the increased impulse towards the right, which in the healthy eye affects the normal internal rectus; also the error in projection is greater in proportion to the increase of the secondary deviation.

In a case of nearly total bilateral ophthalmoplegia, the movements of the eyes in the horizontal meridian were nearly abolished, while upwards and downwards nearly normal. Double images were crossed when the object was less than 110 *cm* removed and homonymous when the distance was greater. Between 110 *cm* and 125 *cm* the object was seen single. The lateral separation of the double images increased but slightly on moving the object to either side. Projection was correct only in a very small zone; and always when the object was to the right or to the left, the localization would be farther to the given side, and so much the more as the object was moved to the side.

In this case it is noteworthy that with a lateral position of the object, neither of the double images was seen where the object actually was. With monocular projection, the condition was as if the lateral muscle of the examined eye was affected; in proportion as the object was moved to the side, the error in projection increased, although neither eye was turned in the direction where the patient indicated the object to be. The motility of both eyes in the horizontal plane was nearly abolished; the lateral separation of the images increased only slightly; the increasing error in the

projection must then be attributed to the loss of orientation depending on the intended but unattained movement.

It is obvious that the projection test may be utilized as an important aid in diagnosis, especially in those having but one eye, where there is reason to suspect a disturbance of motility.

III.

In the first portion of this paper the share taken by the retina in the occurrence of the projection test was discussed; in the second portion, the part played by the ocular muscles; and there remains to consider the share taken by the hand or upper extremity. We may assume that the act of reaching for a seen object is an attempt to put the hand in that part of the visual field occupied by the object to be touched; but we must not forget that the object before it is touched has aroused no tactile sensation, and is not therefore in an imaginary tactile field. The act of touching requires an innervation from the motor centre of the upper extremity, which, by association fibres, receives its stimulus from the centre of the ocular muscles, or directly from the central projections of the different retinal points. The history of a case illustrates these points: A man with partial right hemiparesis, the upper extremity not being affected, however, had conjugate paralysis of the left lateral muscles (left externus and right internus). There was no diplopia and no defect of the fields of vision. $V = \frac{6}{18}$.

Objects to the right were touched quickly and accurately; when an attempt was made to touch an object in the left half of the field, however, the finger passed with peculiar uncertainty on each side of it and even above or below, and not, as one would expect from the nature of the ocular paralysis, outwards or farther to the left. The object was distinctly seen during the attempts to touch it.

In order to explain this case we must assume a lesion of the above-mentioned association fibres.

There follows a theoretical discussion which can hardly be abstracted, and for which reference must be made to the original.

XII.—Advancement of the Levator Palpebræ Superioris with Division of its Insertion. Two New Methods in Congenital Ptosis.

By Dr. **HUGO WOLFF**, Berlin.

The various methods of operating for ptosis are reviewed from the time of von Graefe to Eversbusch, who again drew attention to the levator palpebræ superioris.

The principal insertion of the levator is in the anterior surface of the tarsus about midway between the free margin and the convex border. It is parallel to the free margin, and is separated from the underlying upper half of the tarsus by loose connective tissue, so that the tendon is easy to isolate. The tendon is as strong as the tendon of one of the lateral muscles. From its anterior surface prolongations pass forward to the orbicularis and to the skin. The fact that the distinct line of insertion of the levator tendon is found 5 *mm* below the convex border deserves consideration from a surgical standpoint.

The same principle that Schweigger has applied to the lateral muscles may be used for the advancement of the levator. In the middle of its fan-shaped portion, a piece about 1 *cm* broad may be isolated and the central end brought forward and attached to the stump of the tendon at its insertion into the tarsus. In a case described, the levator was isolated upon two strabismus hooks, a portion about 7 *mm* long, corresponding to the difference in the height of the lids, was removed, and the muscle brought forward and sutured to its stump. The result was satisfactory and has not diminished in six months.

This method is useful where the lid is thick or the orbicularis overacts, in which case a portion may be excised; and where, because of symblepharon, the conjunctival approach to the levator is difficult.

To reach the levator and Müller's muscle from the conjunctival side it is necessary to evert the lid, then with a forceps to seize the convex border of the tarsus and evert it a second time. The conjunctiva is divided horizontally for 2 *mm*, exposing the levator and Müller's muscle, which latter may be

resected and sutured to its stump at the convex border. Three cases have been under observation for 7, 6, and 4 months, and the result has been satisfactory and has remained constant.

The assumption of the congenital absence of the levator is not sufficiently supported by autopsies.[1] And, on the other hand, there are reports of autopsies which show the presence of the levator in congenital ptosis.[2] According to Kunn,[3] the degree of the ptosis has no bearing on the functional activity of the levator. "Ptosis may be slight and the levator not able to raise the lid higher, and on the other hand in complete ptosis, by a strong voluntary effort, it may be raised considerably."

In some cases the presence and activity of the levator may be demonstrated. If one lid is held closed by the finger, and the patient looks upward as far as possible, the lid of the other eye is raised to its normal height. This may be explained by the equal distribution of nerve energy to all the muscles of the eye. The closed eye receives an increased impulse which is shared by the other side. If the lid remains motionless the exaggerated action shows itself in the rectus superior.

These operations are indicated in congenital ptosis of moderate degree where shortening of the levator from 4 to 6 *mm* is required, wherever the muscle shows signs of functional activity.

XVI.—Statistical Contribution to the Study of Congenital Amblyopia.

By Dr. **M. STRAUB**, Amsterdam.

The first portion of this paper contains a review of the literature of the subject, including references to a number of cases reported by ten authors, in which the vision of amblyopic eyes has improved after squint operations and

[1] Heuck, "Ueber angeborenen vererbten Beweglichkeitsdefect der Augen," *Klin. Monatsbl. f. Augenh.*, 1879, p. 253.

[2] Siemerling, "Anatom. Befund bei Einseitiger Congen. Ptosis," *Arch. f. Psych. und Nervenkr.*, Bd. xxiii., 1892, p. 764.

[3] C. Kunn, "Die angebor. Beweglichkeitsdefecte des Auges," *Beiträge zur Augenheilkunde*, Heft xix., 1895, p. 20.

exercises. The attempts to explain congenital amblyopia by retinal hemorrhage or traumatism at birth are briefly referred to.

In the selection of cases of amblyopia, those due to errors of refraction must be eliminated, and to this end the author establishes the degrees of vision that may be expected in hypermetropia and astigmatism in eyes otherwise normal. In myopia defective vision usually depends on visible changes at the posterior pole of the eye, so that it does not enter into a consideration of the question of amblyopia. Vision of $\frac{3}{4}$ may be considered normal for H. 0.5 D—H. 2.5 D, and vision of $\frac{1}{3}$ is given as normal for H. 3. D—H. 7. D. In astigmatism of all degrees normal vision in the cases here tabulated ranges between $\frac{1}{2}$ and $\frac{1}{4}$.

The results of the examination of 159 cases of amblyopia gave 37 % with strabismus, 62 % lacking binocular vision (including strabismus), 60 % anisometropia, and 17 % isometropia having binocular vision. From this the conclusion is reached that because of the number of cases (17 %) of amblyopia with binocular vision and equal refraction, the explanation of amblyopia from disuse fails, and a primary defect must be assumed as a cause of the amblyopia. Hypermetropia was found in 51 % of the amblyopic eyes examined, and this was the more surprising as there were but 151 cases of hypermetropia among all the eyes examined, as compared with 373 cases of astigmatism. Further, the hypermetropic eyes of the anisometropes are most often amblyopic, the better eye being emmetropic or slightly hypermetropic. Why, then, is it that a congenitally amblyopic eye in the large majority of cases is hypermetropic? The inevitable answer is that it retains the congenital refraction, the normal hypermetropia of infancy, because it does not develop into emmetropia as does the healthy eye. In other words, probably as a result of traumatism during birth,[1] exceptionally both eyes, oftenest one eye, becomes inferior, and as a result remains hypermetropic, does not

[1] Königstein, *Medic. Jahrbücher der K. K. Gesellschaft der Aerzte in Wien*, 1881. Schleich, *Mittheilungen aus der Ophthal. Klinik in Tübingen*, 1884. Naumhoff, *Arch. f. Ophthal.*, xxxvi., 3, 1890.

share in binocular vision, and, in a smaller percentage of cases, squints. In most of the cases of amblyopia examined there was found a scotoma for small objects, of 5° or 10° near the fixation point, while the periphery was normal.

Congenital amblyopia may be divided clinically into several groups: amblyopia with emmetropia; monocular amblyopia with isometropia; monocular amblyopia with ammetropia and with emmetropia of the better eye; amblyopia of the more hypermetropic of two hypermetropic eyes. A consideration of these groups with the aid of numerous tables leads to the conclusion that neither strabismus nor the absence of binocular vision is enough, in general, to explain monocular amblyopia; anisometropia might better be assumed as a cause were that not opposed by the association of amblyopia and isometropia. If, finally, anisometropia is not the cause of amblyopia, then the opposite is true, as the association between the two is established.

XVIII.—Investigations as to the Occurrence of Striated Opacities of the Cornea.

By Prof. **HESS**, Leipsic.

The author defends his position that the opacities following cataract extraction are due to folding of the deeper layers of the cornea, caused by a difference in tension between the horizontal and vertical meridians of the cornea after its section, which acts as if the cornea were compressed from the sides. The paper is a polemic, dealing with the opinions of Nuël, Müller, and Schirmer.

One pathological examination is given, supporting the thesis in full. In this case the striated opacities followed a perforating wound of the cornea, and had persisted for eleven years. In the deepest layers of the cornea was a system of ten or twelve fine grayish lines, radiating from the cicatrix, similar in appearance to those following cataract extraction. Descemet's membrane with its epithelium was normal; the deepest layers of the cornea were folded as described in a previous paper. There was no sign of œdema, which, moreover, would be an untenable explanation because of the long duration of the case.

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HESS, "Klinische und experimentelle Studie über die Entstehung der streifenförmigen Hornhauttrübung nach der Staarextraction," *Archiv für Ophthalmologie*, Bd. xxxviii., 4, S. 1.

MÜLLER, "Experimentelle Untersuchungen über die Entstehung der streifenförmigen Hornhauttrübungen nach Staarextraction, *Inaugural-Dissertation*, Greifswald, 1893.

SCHIRMER, "Ueber Faltungstrübungen der Hornhaut," *Arch. f. Ophth.*, xlii., 3, S. 1.

XIX.—NOTES ON CHANGES IN NEUROGLIA CELLS IN INFLAMED AND DEGENERATED OPTIC NERVES.

BY DR. **RICHARD GREEFF**, BERLIN.

Examinations of pathological changes in neuroglia cells by the Golgi-Cajal method will always be somewhat incomplete, because we obtain no exact information concerning the topography and the extent of the changes. It is often a matter of chance, in fact, how many cells are stained. I have, however, for some years found constant changes in the neuroglia cells in various forms of disease of the optic nerve, a preliminary report of which will be of interest.

The difference between the olfactory and optic nerves and the other cranial nerves is made especially clear by the method of staining neuroglia. In the other nerves a few neuroglia cells are found in the roots, while in the first and second nerves they may be traced to the end of the nerves. Their normal appearance has been described in a previous paper.[1]

In cases of ascending interstitial neuritis and perineuritis in which a portion of the optic nerve was resected because of threatened sympathetic ophthalmia, the Golgi method

[1] Greeff, "Die Spinnenzellen im Schnerv und in der Retina," *Archiv f. Augenheilk.*, Bd. xxix., S. 324.

showed the neuroglia cells to have undergone marked changes.

The cell-body is always swollen, more in acute than in chronic cases. Sometimes it is remarkably increased in size and quite irregular in shape and position. Some of the processes, especially the shorter ones, are much thickened, and some appear flattened like broad bands. All of the processes have become varicose, angular, and tortuous. With the thickened processes are others which are very long and fine, also bent and twisted, less varicose, but often having a swelling at their extremity. The more intense the inflammation has been, the more marked are the changes in cell-body and processes. Such changes are found in inflammatory processes in brain and spinal cord, in progressive paralysis, sclerosis, etc.

An entirely different picture is found in simple atrophy of the optic nerve. This condition was produced in young pigeons and rabbits according to Gudden's method by means of evisceration of the eye, leaving the sclera and the sheaths of the nerve intact. This method does not produce a simple atrophy of the fibres of the optic nerve however, as a few days after the operation, there is fibrinous exudation in the subvaginal lymph spaces and moderate inflammation in the trunk of the nerve. In animals killed four months later, atrophy of the nerve is complete. In these cases there is a great increase in the processes of the neuroglia cells, they are not thick and ribbon-shaped as in inflammation of the nerve but enormously increased in number, the new fibres appearing shorter than the normal. The cell-body is not swollen.

Thus the statement, that wherever nerve tissue perishes neuroglia is developed, is established.

A transition between the coarse-fibred proliferation in interstitial neuritis and the finer development in simple atrophy is shown in a case of inflammatory atrophy following neuritis.

XX.—The Etiology of Pseudo-Membranous Conjunctivitis.

By Dr. **FRITZ SCHANZ**, Dresden.

Four cases of pseudo-membranous conjunctivitis are described in which a bacillus was found which corresponded entirely to the Klebs-Löffler bacillus except that it was harmless to guinea-pigs. The question is raised whether this organism is identical with the diphtheria bacillus or whether it is the xerosis bacillus which is said to be more like the Klebs-Löffler bacillus than is the pseudo-diphtheria bacillus.

Uhthoff, also Roux and Yersin, describe an attenuated form of the diphtheria bacillus found in mild cases and at the end of the disease. The identity of this form with the xerosis bacillus would separate it from the family of the Klebs-Löffler as the former occurs in totally different conditions.

It should be shown whether the environment does not induce the virulence. Fibrin is an admirable soil and such favorable conditions might bring it about that the bacillus would become virulent for guinea-pigs. Under these conditions, however, it could not produce the membrane nor could it be regarded as the cause of diphtheria.

We find in pseudo-membranous conjunctivitis, a disease which for years has not been considered as diphtheria, the Löffler bacillus, and in addition, an exactly similar bacillus, which however is not virulent. The relation between these two bacteria is not yet clear.

XXVII.—The Transplantation of Bridge-shaped Conjunctival Flaps for the Protection of Large Corneal Defects with Prolapse of the Iris.

By Prof. **LEOPOLD WEISS**, Heidelberg.

I wish to report the success attending the use of a method intended to prevent the development of staphyloma in cases of extensive corneal destruction with prolapse of the iris. The method has been tried only in a few cases as

yet, and only where the ordinary procedure had been unavailing and staphyloma seemed inevitable. A description of different cases will best introduce a discussion of this method.

CASE I.—Auguste B., æt. six, had a large ulcer involving the greater part of the lower half of the cornea. The ulcer had perforated, the iris with the pupillary margin is prolapsed and ballooned forward. The anterior chamber is abolished. The margins of the ulcer are purulent.

Ordinary treatment being ineffectual to check the progress of the ulcer and beginning staphyloma, I decided to cover the large defect by transplanting a bridge-shaped flap of conjunctiva as shown in the cut. First the flap was marked out with a sclerotome,

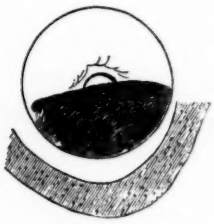

FIG. 1.

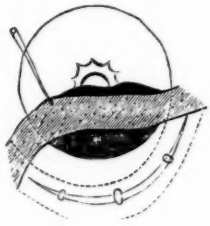

FIG. 2.

then the conjunctiva with the subconjunctival tissue dissected off. The flap was then drawn upward and laid over the prolapsed iris. To fix the flap in place a suture was passed provisionally, from the nasal side upwards, and attached just above the cornea, as shown in Fig. 2. Finally the wound left by the removal of the flap was closed loosely with three sutures. Iodoform was dusted on the eye and both eyes bandaged.

The result was unexpectedly good. The flap remained in place, and in two days the anterior chamber was re-established; the ulcer made no further progress, its floor cleared up, and considerable repair of the cornea took place, especially in the lower, inner portion, where a small margin of cornea had remained. The transplanted flap, instead of being infiltrated with pus from the ulcer, seemed by the contact of its healthy vascular tissue to influence healing by offering an unfavorable condition for the further development of bacteria. The protruding prolapse flattened under the flap, and the perforation was quickly closed, as

the anterior chamber began to fill on the next day. The result was permanent, and in course of time the cornea became clearer, so that a year after the operation V was $\frac{6}{10}$ and the appearance as shown in Fig. 3. The cosmetic result was not satisfactory, as the

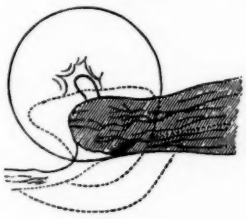

FIG. 3.

vascular band lay like a pterygium across the cornea, especially to the temporal side where it was firmly adherent to the tissue beneath. The vascularization was much diminished by two vertical incisions and sutures.

CASE 2.—August L., æt. nine. R. E. Rather more than half the cornea was involved, the entire lower portion being occupied by a purulent ulcer which had perforated in the lower, outer quadrant. Above the margin of the ulcer, in the clear cornea, small infiltrations were to be seen in the deeper layers. In the anterior chamber was a large exudation. The ulcer had been noticed only a few days before, and had probably followed infection from a furuncle on the forehead.

Because of its very rapid progress the prognosis was most unfavorable.

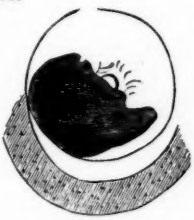

FIG. 4.

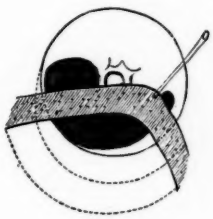

FIG. 5.

The operation was performed as already described (Figs. 4 and 5). On the following day, slight œdema of the lids, moderate secretion. On the second day there was much secretion and swelling ; a quantity of thin, sero-purulent fluid, as in " pseudo-

blennorrhœa" in girls with vaginal discharge, flowed from between the swollen lids. In a similar case with croupous membrane on the conjunctiva, staphylacoccus pyogenes aureus was found. Frequent changes of dressing, antiseptics, and especially weak solutions of acetate of aluminium improved the condition and on the fifth day the ulcer appeared nearly clean, the anterior chamber filled, and the transplanted flap healed on the temporal side; in the middle it had broken down and the remainder had retracted toward its base. Later, the eye became nearly free from irritation and painless. The iris and lower pupillary margin formed part of the cicatrix. A broad, vascular band passed like a pterygium from the temporal side to the centre of the cornea, under the edge of which, at the limbus, a sound may be passed. $V = \frac{6}{15}$.

CASE 3.—In this case there was a partial, conical staphyloma of the cornea, for which iridectomy was performed followed by abscission of the staphyloma with transplantation of a flap of conjunctiva.

Minna O. æt. six. The right eye had recently suffered from a severe inflammation which led to the rapid development of a staphyloma which protruded between the lids.

The entire lower half of the cornea was occupied by a conical protrusion with a broad round base; above this the anterior chamber was seen to be shallow and the edge of the pupil visible. At the base of the staphyloma was a broad opacity and its apex was flattened and vascular. After iridectomy and abscission the protrusion returned; this was again removed, the lens extracted, the lips of the wound united by three catgut sutures, and over this a bridge-shaped flap was brought and fastened by two provisional sutures upwards. The result was satisfactory, the cicatrix firm and flat, and there has been as yet no sign of a recurrence.

This case seems of importance because frequently an ectatic cicatrix, in spite of excision, cauterization, iridectomy, etc., returns with increased tension until the eye is lost.[1]

[1] E. Fuchs, "Ueber Keratoplastik." *Verhandl. d. Ges. deutsch. Naturforscher und Aerzte*, Wien, 1894, S. 211.

In Case 4 also, where almost the entire cornea was destroyed and the iris prolapsed, transplantation led to a flat cicatrix; but the case has not been observed long enough to be certain whether the result is permanent.

As in this case, if only a portion of the prolapse is covered with conjunctiva, the nutrition seems to be so much improved that better conditions are obtained for regeneration.

Alex. Pagenstecher seems to have been the first, about thirty-six years ago, to use flaps of conjunctiva in the treatment of ulcers of the cornea. In 1876 Schöler defined the indications for the method as follows:

1. In all large and threatening ulcerations.
   - *a.* Where perforation is imminent.
   - *b.* Where perforation has taken place.
     - *α.* Without prolapse of the iris.
     - *β.* With prolapse. The presence of secretion makes the operation more urgent, after disinfection of the ulcer.
2. In open wounds of the cornea with or without prolapse of the iris.
3. In corneal fistulæ, after freshening the edges of the fistula.
4. In partial, stationary staphyloma.
5. In total staphyloma.
6. In perforating scleral wounds and ulcers.
7. In cystoid cicatrix.

In the operation preferred by Schöler, the epithelial side of the flap was in contact with the cornea, and, in consequence, adhesion often was not obtained and the conjunctival flap shrunk.

Kuhnt later applied the operation to peripheral ulcers and wounds of the cornea, especially to lessen the danger, often postponed for years, following incarcerations of the iris.

Kuhnt at the Ophthalmological Congress at Heidelberg, in 1885, and da Gama Pinto[1] recommended the use of pieces of conjunctiva without pedicles.

E. Meyer, Swanzy, Leber, and others have expressed the opinion that the presence of iris tissue in corneal wounds

[1] *Klin. Monatsbl. f. Augenh.*, 1887, 25 Bd., S. 1.

opens a door to later infection and is a constant danger to the eye; while v. Zehender attributes the resulting inflammations of the uveal tract to traction on the iris, and makes a small iridectomy near or opposite to the prolapse.

According to the present state of the question, that purulent irido-cyclitis in old cases of peripheral, anterior synechiæ is a result of infection through the cicatrix, it is rational to cover the cicatrix with conjunctiva, in order to lessen the danger of infection.

Ed. Meyer makes use of conjunctival transplantation in incarceration of the iris and in such corneal or scleral scars as have ectatic edges which would be likely to admit infection. The methods used by him, according to the case, are as follows[1]:

1. When a cicatrix lies in the conjunctival region, he excises the latter over the scar, loosens it on one side so that it can be drawn across without difficulty, and sutures it on the other side of the cicatrix. (Fig. 10, *a*.)

2. If there is a cicatrix in the cornea, he forms a conjunctival flap parallel to the corneal margin nearest the scar, draws it over the scar, and sutures it to the sclera opposite, having removed the conjunctiva at this point. (Fig. 10, *b*.)

FIG. 10, *a*.

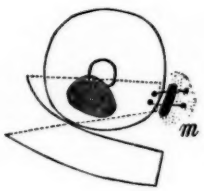

FIG. 10, *b*.

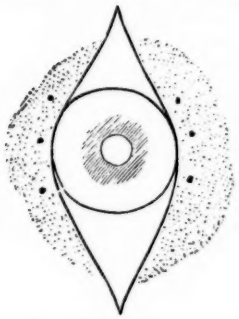

FIG. 10, *c*.

3. In extensive ulcerating cicatrices of the cornea, the conjunctiva on the nasal and temporal side, throughout its periphery, is loosened as far back as the equator and drawn

[1] Communicated by letter.

over the cornea and sewed together. To avoid folds, a wedge-shaped piece of conjunctiva is excised above and below. It is as easy to loosen the conjunctiva above and below and sew it horizontally over the cornea. (Fig. 10, *c.*)

In all these operations, ectatic scars are first levelled with the thermo-cautery.

XXIX.—The Prophylaxis of Sympathetic Ophthalmia.

By Dr. **GEORGE ABELSDORFF**, Berlin.

For the prevention of sympathetic inflammation, three operations are available, namely, enucleation, evisceration, and resection of the optic nerve. None of these is infallible since the chief condition, a sufficiently early intervention, is often lacking. Three and possibly four cases are mentioned, reported by Dransart, Cross, and Waldispühl, in which sympathetic ophthalmia followed evisceration.

In the present case, evisceration and resection of the nerve, performed four weeks after the traumatism, were both unavailing to prevent the onset of sympathetic ophthalmia, which appeared in the left eye of a child seven weeks after a wound of the right cornea by a piece of glass. The eye had remained inflamed and painful, and vision was lost. There was extreme circumcorneal injection, and a staphylomatous cicatrix of the cornea. The wound did not extend beyond the limbus. A foreign body was not found in the eye.

Three weeks after the combined evisceration and resection, the left eye was attacked by severe irido-cyclitis, for which treatment was unavailing.

SYSTEMATIC REPORT ON THE PROGRESS OF OPHTHALMOLOGY IN THE FIRST QUARTER OF THE YEAR 1899.

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WITH THE ASSISTANCE OF

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Translated by Dr. Ward A. Holden.

(*Continued from page 468.*)

XII.—CORNEA, SCLERA, AND ANTERIOR CHAMBER.

739. Koster. A case of zona ophtalmique with interstitial keratitis without epithelial lesions. *Ann. d'ocul.*, cxxi., p. 96.

740. Terson. Two cases of parenchymatous keratitis in acquired syphilis, with presentation of patients. *Ibid.*, p. 43.

741. Petit. On a particular form of corneal infection of serpiginous type. *Ibid.*, p. 166.

742. Zinn. On the treatment of hypopyon keratitis. *Wiener klin. Wochenschr.*, 1899, No. 9.

743. Uhlenhuth. A case of lepra tuberosa with a beginning

leprous affection of the cornea (keratitis superficialis punctata). *Charité Annalen.* xxiii.

744. TROUSSEAU. Tattooing the cornea and sympathetic ophthalmia. *Ann. d'ocul.*, cxxvii., p. 185.

745. VALUDE. An episcleral fibro-cartilaginous plaque. *Ann. d'ocul.*, cxxi, p. 118.

746. HENNICKE. The extraction of a mass of conglomerate containing a splinter of iron from the anterior chamber. *Zehender's klin. Monatsbl.*, xxxvii., p. 29.

747. ELLETT. A series of cases of malarial keratitis with a report of the blood examination. *Ophth. Record*, March, 1899.

748. LEDBETTER. Keratitis herpetica. *Am. Journ. of Ophth.*, March, 1899.

749. BRUNS. A case of xerosis of the cornea, hemeralopia, and bleeding from the gums. *Ibid.*

750. STIEREN. Œdematous changes in the epithelium of the cornea in a case of uveitis following gonorrhœal ophthalmia. *Johns Hopkins Hospital Bull.*, Dec., 1898.

751. MUNCASTER. Hernia of the sclerotic. *Ophth. Record*, Jan., 1899.

752. GIFFORD. Ulcus rodens corneæ. *Zehender's klin. Monatsbl.*, xxxvii., p. 77.

Serpent ulcer of the cornea is now commonly and rightly believed to be due to pneumococcus infection. PETIT (741), a pupil of Morax's, has observed a number of cases of serpent ulcer which were distinguished clinically by absence of pain in spite of the hypopyon, and by the absence of posterior synechiæ. Most of the patients suffered from stenosis of the lachrymal duct. The pus from these ulcers contained great numbers of diplobacilli (2 μ long and 1–1.5 μ thick). In bouillon cultures they assumed the shape of diplococci. The microörganism is not pathogenic for animals, and does not retain the stain by Gram's method. It grows on the ordinary culture media, and fluidifies gelatine. Its vitality is greater than that of the Morax diplobacillus, and it can live for days in a temperature of 15°–20° C.

ZINN (742) cauterizes at once every serpent ulcer complicated with hypopyon ; the anterior chamber may be punctured peripherically with a lance knife, and then only mild means of treatment are employed. Sæmisch's operation is rejected on account of its consequences. Subconjunctival injections of salt solution are

not of sufficient benefit to make up for the pain they cause. The contents of the tear sac should be expressed rather than syringed out, or the sac may be incised or extirpated.

In UHLENHUTH's (743) patient, who had suffered for twelve years with leprosy, the left eye had for nine months presented a central corneal opacity, representing a tuberous form of lepra. It consisted of large nodules and fine points which were arranged in concentric arcs at the corneal margin. The epithelium above them was present. The vessels about the cornea were but slightly enlarged and there were no new vessels in the cornea. Nodules were present in the lids, and the eyebrows and lashes were wanting.

TROUSSEAU (744) records a number of cases which show that tattooing of the cornea may cause an outbreak of iridocyclitis and sympathetic ophthalmia. If anterior synechiæ exist this is easy to explain, but Trousseau had seen this unfavorable result even after tattooing simple leucomas. SULZER.

VALUDE (745) extirpated a small episcleral tumor from the equatorial region between the superior and the external rectus in a boy of eight. The tumor was adherent by a pedicle to a depression in the sclera. It was congenital, but had recently increased in size. It consisted of fibro-cartilage. SULZER.

HENNICKE (746) was able with a magnet to remove from the anterior chamber a small splinter of iron adherent to a mass of stone. In the beginning this had become negatively magnetic and eluded the forceps.

ELLETT (747) reports nine cases of keratitis of the dendritic variety associated in every instance with malaria, as determined by the blood examinations. The tertian or quartan forms were the most common. The patients were both white and negro, and only one eye was affected in each case. No organisms were found in the material scraped from the furrows in the cornea.

BURNETT.

LEDBETTER (748) gives the histories of three cases of seemingly typical keratitis dendritica in men who though strong were run down. None had had malarial poisoning in any form.

BURNETT.

The point of interest in this case of BRUNS's (749) is that the eye symptoms of conjunctival xerosis and night-blindness were due to a scorbutic condition, the patient having lived principally on salted bacon and Irish potatoes. Improved nourishment proved a cure. BURNETT.

The specimen described by STIEREN (750) was an eye that had been lost from gonorrhœal ophthalmia in which a perforation of the cornea and prolapse of the iris had occurred. The corneal epithelium showed the kind of vacuoles which have been observed in glaucoma. They were caused in this instance, the author thinks, by the closure of the lymph channels and retention of the lymph in the lymph spaces of the cornea. There was also, in all probability, an increase in the quantity of the lymph, brought about by the undue determination of blood. BURNETT.

MUNCASTER (751) reports a case of staphyloma of the sclera, evidently due to an attempt to remove an opaque lens which was seen floating in the vitreous. An iridectomy had been made. The bulging sclera, which was very thin, was 4 *mm* above the level of the surface and 4 *mm* in diameter at its base. BURNETT.

GIFFORD (752) treated in the usual way a rodent ulcer of the cornea following traumatism, without result, until he extirpated the conjunctiva, which had become undermined in nearly the entire circumference of the cornea, after which the process ceased to advance.

Sections XIII.–XVIII. Reviewed by DR. O. BRECHT, Berlin.

XIII.—LENS.

753. DE OBARRIO. On congenital cataract in a rabbit. *Centralbl. f. prakt. Augenheilk.*, xxiii.

754. KUHNT. On operations for secondary cataract. *Zeitschr. f. Augenheilk.*, i., pp. 151 and 260.

755. NUEL. Etiology and pathology of anterior polar cataract. *Arch. d'opht.*, xix., 1, p. 6.

756. WESTHOFF. A case of congenital bilateral luxation of the lens. *Med. Weekblad*, 1899, March 25.

757. TERSON. On extraction of cataract in keratoconus. *Arch. d'opht.*, xix., 2, p. 125.

758. TERSON. A precise indication for the extraction of soft cataract by means of aspiration. *Ann. d'ocul.*, cxxi., p. 161.

759. VALUDE. Expulsive hemorrhage after extraction of cataract. Reclination of the lens in the other eye. *Ann. d'ocul.*, cxxi., p. 33.

760. DADDI. Observations on post-mortem cataract in kittens. *Annali di Ottalm.*, xxvii., 4.

761. BIETTI. Modifications of structure in a luxated but still transparent lens. *Ibid.*

762. ADDARIO. On an anomaly of conformation of the lens, with a contribution to the development of the eye in the vertebrates. *Arch. di Ottalm.*, v., p. 51.

763. ANGELUCCI. A modification of the process of simple extraction. *Ibid.*, p 71.

764. KUHNT. Successful treatment of corneal suppuration (pneumococcus infection) after extraction. *Zeitschr. f. Augenheilk.*, i., 1, p. 52.

765. WETTENDORFER. Further cases of juvenile total cataract due to tetanus, with a contribution to the histology and histochemistry of cataract. *Beiträge zur Augenheilk.*, xxxviii.

766. FRYER. Profuse hemorrhage subsequent to the extraction of senile cataract. *Amer. Journ. of Ophthal.*, Feb., 1899.

767. ALT. On the pathology of cataract, especially in its earliest stages. *Ibid.*

768. BRUNS. Two cases of discission of lens in high myopia. *Ibid.*, March, 1899.

769. MARLOW. Spontaneous absorption of senile cataract with restoration of vision. *N. Y. Med. Journ.*, Jan. 14, 1899.

DE OBARRIO (753) found accidentally in a rabbit an opacity of the lens. There was a limited zone of opacity in the cortex and a second in the otherwise clear nucleus.

KUHNT (754) gives in detail his views on secondary operations, of which he has done 709 in fourteen years. He prefers discission with one or two small knives.

NUEL (755) believes that the ordinary anterior polar cataract is not congenital, but mostly a result of blennorrhœa. Nuel examines all of his cases of blennorrhœa in the beginning to determine the presence or absence of polar cataract. In two cases in which there was corneal ulcer without perforation anterior polar cataract developed. He assumes that the phlogogenic matters pass from the cornea into the anterior chamber and excite the anterior capsular epithelium to proliferation. A similar process is not observed in adults because the capsular epithelium possesses less excitability, although even here when a perforation exists for some time, or there is hypopyon, cataract may develop.

v. MITTELSTÄDT.

WESTHOFF (756) observed a bilateral luxation of the lens down-

ward and inward in an otherwise normal boy of nine. When the head was held straight vision was very poor, and he required +12 D for distance and +16 for near. By bending his head forward and to the side, the rays of light then passing through the margin of the lens, he was able to read without glasses when the print was held very close.

The removal of soft cataract by aspiration has given good results in the hands of Belgian oculists (Coppez, Redard, Rogman and others). TERSON (758) by this method removed with ease a luxated traumatic cataract in a boy of seventeen. He avoided in this way the danger of forcing the lens back into the vitreous in the attempt at extraction. With a lance knife he made a corneal incision 6 *mm* long and divided the capsule with a cystitome. The canula of an Anel syringe was then introduced through these two wounds and after a slow aspirating movement the pupil suddenly became black. SULZER.

In a patient in whom extraction led to profuse intraocular hemorrhage, VALUDE (759) performed reclination on the other eye. The result was excellent. The author asks whether this simple and easily performed operation really deserves its bad reputation, and whether it is not frequently indicated. In order to avoid rupture of the capsule Valude passes a blunt curette through the scleral incision, and with this forces the lens downward.

SULZER.

The observations and experiments which form the basis of DADDI'S (760) paper concern the temporary opacity of the centre of the lens which comes on after death in kittens. These opacities, which can be produced and then be made to disappear by warming and cooling the lens, do not depend, according to the author, on changes in the watery components of the lens. He believes that the amount of water in the lens gradually decreases with age, and that in the kitten's lens certain temperatures cause a precipitation of albuminous matters which at other temperatures redissolve. KRAHNSTÖVER.

BIETTI (761) reports the microscopic examination of a lens which was dislocated backward a month before but still remained transparent. He finds that the first changes occur in the cortex as in all soft and quickly developing forms of cataract.

KRAHNSTÖVER.

In cataract extraction ANGELUCCI (763) uses no speculum, but grasps the conjunctiva and the underlying tendon of the superior

rectus with a broad fixing forceps. This forceps holds back the upper lid and serves to fix the eye. The capsule is opened with the knife between puncture and counter-puncture.

A similar operation, though one more radical in its simplicity, is done by Trousseau, who merely retracts the lids with the thumb and index finger of one hand, and performs the entire operation with the linear knife alone. KRAHNSTÖVER.

KUHNT (764) extracted a cataract from an eye ten weeks after removal of the tear sac for chronic suppuration. At the first dressing, four days after operation, the eye appeared somewhat irritated, and four days later there was iridocyclitis with suppuration of the corneal wound and hypopyon. A large infiltrated flap of cornea was excised, and the defect covered with conjunctival flaps. Smooth healing occurred, with good vision. The author prefers his procedure to that of destroying the affected part with the galvano-cautery.

FRYER'S (766) case was a woman of seventy-four years, in whom there developed a glaucoma of the right eye, for which an iridectomy was done, after which the symptoms subsided. A cataract developed, and a year after the iridectomy an extraction was made. The patient was quiet, and the lens was delivered easily. No collapse of cornea; wound edges well adapted; no loss of vitreous. Four hours after the operation a profuse hemorrhage took place, and the eye became atrophied. The other eye was already lost and atrophied from causes that could not be learned.

BURNETT.

As a result of the examination and study of a large number of cataracts histologically, and of which a number of illustrations are given from photographs of the specimens, ALT (767) concludes that the formation of a cataract is somewhat as follows: First, there is a sclerosis of the nucleus causing fissures between the lens fibres. Then follows an imbibition of the lens fibres with fluids from without, aiding in the destruction of these fibres, especially at the equatorial terminus of the seams. Then comes the formation of chemical substances which act as irritants on the younger fibres and capsular epithelium. We have then a formation of spindle-shaped swellings in the lens fibres, and of the vesicular cells in the epithelial layer, especially near the equator, probably caused by the imbibition of fluid from the outside. Further imbibition may lead to the formation of large cavities, or even the Morgagnian form of almost complete fluidity. There

may be other products of regressive metamorphosis, such as deposits of lime, crystals of fatty acids, cholesterin, etc.

BURNETT.

In the first of BRUNS's (768) cases the M in the R. eye was — 16 and with this V = $\frac{20}{40}$. After discission and taking away the opaque capsule with + 3 105° V = $\frac{20}{60}$. In the second case R with — 16 ⌒ — 2 165° $\frac{20}{100}$; L — 16 ⌒ — 2 180° $\frac{20}{60}$. After absorption, R V = $\frac{20}{40}$ without a glass; L $\frac{20}{50}$. BURNETT.

MARLOW (769) reports a case of hypermature cataract in which the zonula and capsule were apparently ruptured, causing a dislocation of the nucleus and capsule into the anterior chamber, With + 10 V = $\frac{6}{36}$. The patient was about eighty years of age.

BURNETT.

XV.—CHOROID.

770. LEVINSOHN. On sclerosis of the choroid with secondary degeneration of the retina. *Arch. f. Augenheilk.*, xxxviii., p. 268,

771. HANKE. On intraocular tumors. *Graefe's Archiv*, xlvii., p. 463.

772. JARNOTOWSKI. A contribution to iridocyclitis or phthisis bulbi in cases of sarcoma of the choroid. *Arch. f. Augenheilk.*, xxxviii., p. 382.

773. WAGENMANN. A case of specific choroiditis disseminata combined with retinitis hemorrhagica in the same eye. *Ophth. Klinik*, 1899, No. 2.

774. CHEVALLEREAU. Sarcoma of the choroid. *Ann. d'ocul.*, cxxi., p. 203.

LEVINSOHN (770) describes a case of pronounced sclerosis of the choroidal vessels, without sclerosis of other vessels, but accompanied by atrophy of the retina. The patient was a man of sixty, who was otherwise healthy and had never been seriously ill. For seven years he had complained of failing vision and hemeralopia. R V=$\frac{3}{10}$; L V=$\frac{4}{15}$. Visual fields contracted on all sides to 10°, while a narrow strip in the periphery was here and there preserved. Colors were recognized only in the centre. Pupillary reaction was sluggish and there were senile changes at the æquator of the lens. Fine opacities were seen in the posterior segment of the vitreous. The discs were pale, the arteries much contracted, the veins slightly contracted. About the discs were several large yellowish-white patches, but the maculas were free. The choroi-

dal vessels were visible as white stripes which were partly empty, and in part enclosed a thin column of blood. In the periphery were several small foci of choroiditis. The retinal pigment was heaped up in little masses here and there. The author considers the process to be a senile sclerosis of the choroidal vessels without inflammatory changes, that had its beginning in the ciliary arteries. The clinical picture resembles but is not identical with the *atrophia gyrata chorioideæ et retinæ* of Fuchs.

HANKE (771) describes three intraocular tumors. The first case was one of pigmented tumor of the chamber angle arising from the endothelium of the ligamentum pectinatum in an eye blind from primary glaucoma.

The second case was one of tumor in the ciliary body arising from the unpigmented pars ciliaris retinæ of the ciliary processes, and projecting into the vitreous. This tumor was composed only of cells and large communicating cavities, containing no connective-tissue stroma. The author did not consider it to be either an epithelioma or an adenoma.

The third case occurred in a boy of sixteen. A mixed-celled melano-sarcoma of the choroid perforated the ball at the limbus corneæ without being accompanied with symptoms of glaucoma. In the region of the tumor the choroid showed signs of previous inflammation and the retina was atrophic. The author believes that there was first an inflammation ending in cicatrization from which the tumor arose.

JARNOTOWSKI (772) reports two cases of sarcoma of the choroid. In one case there were pronounced iridocyclitis, hypotony, and moderate shrinking of the ball in a woman of fifty-five, who had noticed failure of vision and severe inflammatory symptoms for two years and a half. The soft, completely blind eye was enucleated on account of the pain. The ball was found to contain a pigmented, partly alveolar tumor which nearly filled the vitreous chamber and was so necrotic that the nature of its component cells could not be determined. The uveal tract and the retina were atrophic and showed signs of previous plastic inflammation. No microörganisms were found, and the author, therefore, attributes the necrosis to the cyclitis, according to the view held by Leber, Krahnstöver, and Evetzky.

The second case was in a man of fifty-two, who had noticed a diminution of vision since the spring of 1894, and had suffered an injury in the region of the eye in the summer of 1894. In

August, 1898, the painful, phthisical eye was enucleated. A mixed-celled melano-sarcoma was found in the eye, with evidences of plastic iridocyclitis. In this case also the author thought the sarcoma to be the primary affection, and the phthisis secondary.

WAGENMANN'S (773) patient had, four years previously, an attack of specific disseminate choroiditis which seriously injured vision, but passed off completely under specific treatment. At the present time an ordinary disseminate choroiditis has appeared in the right eye which had not been previously affected, and in the left eye, besides fresh choroidal patches below the disc, there is an extensive peripheric hemorrhagic retinitis in the upper outer quadrant of the fundus. The author believes the cause to have been syphilitic alterations in the walls of the retinal vessels which were seen to be bordered by white lines.

XVI.—VITREOUS.

775. CHODIN. An unusual case of thread-shaped structure in the vitreous (remains of hyaloid artery?) *Wjest. Ophth.*, 1899, No. 2.

776. KASSODUBOSKY. A case of membranous formation in the vitreous. *Ibid.*

In CHODIN'S (775) case the anterior, thicker end of the thread was attached to the lens while the thinner, posterior end was freely movable in the vitreous. The eye was myopic. The author believed the thread to be the remains of a hyaloid artery which had been torn through in the development of the myopic sclerectasia. HIRSCHMANN.

KASSODUBOSKY (776) observed a case of typical disseminate chorio-retinitis that was probably congenital. The disc and the surrounding portion of the fundus were covered with a membranous formation which was elevated more than 2 *mm* above the level of the retina. According to the patient's statement the eye had always had poor vision, which grew worse after a severe intoxication (probably from phosphorus). The author believes that the phosphorus poisoning led to extravasations, and to connective-tissue proliferation, and he regards these new membranes not as constituting Manz's *retinitis proliferans*, but rather as representing Leber's *papillo-retinitis interstitialis hemorrhagica hyperplastica*. HIRSCHMANN.

XVII.—GLAUCOMA.

777. FRIEDRICH. On the results of the operative treatment of chronic glaucoma. *Inaug. dissert.*, Giessen, 1898.

778. LAQUER. Remarks on the nature of inflammatory glaucoma. *Graefe's Archiv*, xlvii., p. 631.

779. NATANSON. On glaucoma with retinitis pigmentosa and myopia. *Wratsch*, xv., 6, p. 109.

780. DEMISCHERI. Sympathectomy in cases of glaucoma. *Ann. d'ocul.*, cxxv., p. 188.

781. ABADIE. Nature and treatment of glaucoma. *Arch. d'opht.*, xix., 2, p. 94.

782. DOLGANOFF. On the pathological anatomy of glaucoma (a clinico-histological study). *Wratsch*, 1899, No. 3.

FRIEDRICH (777) reports on 150 glaucomatous eyes seen in Giessen in the years 1879–1898. The treatment consisted in iridectomy, sclerotomy, and the use of medicamentous remedies. The author concludes that non-operative remedies invariably lead to bad results, and that iridectomy is the most efficacious of the operations. When it alone is not sufficient, its effect may be supplemented by sclerotomy.

Since the present theories as to inflammatory glaucoma are not altogether satisfactory, LAQUER (778) offers the explanation that there are particular nerves which have the exclusive function of regulating the size of the vessels, thus controlling secretion. It is not known in what nerve tracts these fibres are contained, we only know that they are not in the trigeminus.

ABADIE (781) seeks to refute the arguments offered in opposition to his theory that glaucoma arises through excitation of the sympathetic vaso-motor nerves. Even the older experiments of Hippel and Grünhagen showed that an intracranial excitation of the trigeminus (with simultaneous excitation of the accompanying sympathetic fibres) would produce increased tension lasting as long as the excitation continued. In all forms of acute, subacute, or intermittent glaucoma there is an excitation of the vessel-dilating fibres which arise in the medulla and run in the trigeminus, and iridectomy in such cases acts only by dividing these nerve fibres which are causing the increased tension. Excitation of the second, third, and fourth spinal roots of the sympathetic after section of the trunk of the sympathetic on the same side produces a redness of the face on the opposite side. On the strength of

this experiment Abadie would explain in the same way the onset of glaucoma in the healthy eye after iridectomy on the diseased eye. He supposes that in the operation of iridectomy the sympathetic vessel-dilating fibres are torn and injured, and the excitation is conveyed to the corresponding fibres for the other eye and there causes increased tension. In glaucoma simplex, iridectomy is of no avail since the excitation of the vessel-dilating fibres occurs in the cervical sympathetic and its fibres running to the ciliary ganglion. Therefore, Abadie has proposed in these cases the resection of the upper cervical ganglion or the division of its branches. In one patient operated upon in this manner the tension became normal and the vision improved. Although usually the pupil becomes contracted after this operation, in this case of glaucoma the pupil remained of medium size and reacted to light. V. MITTELSTÄDT.

DOLGANOFF (782) reports the case of a boy of eleven in whom discission had been done twice for soft cataract. The result as regarded vision was unsatisfactory. Two months later oblique illumination revealed a vascular tumor close behind the ciliary body. The tumor grew and the tension of the eye became increased. After enucleation the tumor was submitted to microscopic examination and proved to consist merely of detached retina. In the ciliary body he found a cellular infiltration and inflammatory products of long standing, with absorption of pigment from its normal position and its heaping up in clumps. In the iris he found perivasculitis and ectropium iridis ; the periphery of the iris was closely united with the periphery of Descemet's membrane. Fontana's spaces were occluded and Schlemm's canal partially obliterated. The totally detached retina had undergone a connective-tissue degeneration with the formation of cysts and the obliteration of the vessels.

The author regards the iridocyclitis with the adhesions and blocking of the chamber angle as the starting point of the glaucoma. HIRSCHMANN.

XVIII.—SYMPATHETIC OPHTHALMIA.

783. SCHIRMER. On the pathogenesis of sympathetic ophthalmia. *Centralbl. f. pr. Augenheilk.*, xxiii., p. 40.

SCHIRMER'S (783) paper is a polemic against Moll, in which he maintains that sympathetic ophthalmia is of bacterial nature although it is not known whether the microörganisms reach the second eye through the blood-vessels or through the lymphatics.

Sections XIX.–XXII. Reviewed by PROF. GREEFF, Berlin.

XIX.—RETINA AND FUNCTIONAL DISTURBANCES.

784. REIMAR. On retinitis hemorrhagica in consequence of endarteritis proliferans, with the microscopic examination of a case. *Arch. f. Augenheilk.*, xxxviii., p. 209.

785. REIMAR. The so-called embolism of the central artery of the retina and its branches. *Ibid.*, p. 291.

786. LEVIN. On a case of abnormal tortuosity of the retinal vessels. *Ibid.*, p. 257.

787. FISCHER. The operation for myopia and detachment of the retina. *Centralbl. f. Augenheilk.*, xxiii., p. 74.

788. HILBERT. On a subjective light phenomenon, and its relation to scotoma scintillans or hemicrania. *Ibid.*, p. 77.

789. DE SCHWEINITZ. A note on toxic chromatopsia and toxic hysteria. *Ophth. Record*, Jan., 1899.

790. ERWIN. Acute color blindness. *Ibid.*

791. WOODS Blindness following the intoxicating use of Jamaica ginger. Report of 6 cases. *Ibid.*, Feb., 1899.

792. FRIDENBERG, PERCY. The detection of simulated monocular blindness. *Ibid.*, Jan. 1899.

793. WÜRDEMANN AND MURRAY. A case of macular retinitis, due to a flash of electric light. *Ibid.*, May, 1899.

794. VEASEY. A clinical study of double choked disc, in a case of quiet otitic thrombosis of the sigmoid sinus without pyæmia. *Ibid.*, June, 1899.

795. WOOD, CASEY A. The ocular evidences of hysteria *Amer. Journ. Med. Sciences*, Jan., 1899.

796. RYERSON. Lightning stroke causing eye diseases. *Med. Record*, Apr. 22, 1899.

REIMAR (784) made a microscopic examination of an eye in which the ophthalmoscopic diagnosis of thrombosis of the central vein had been made, and glaucoma supervening necessitated enucleation. In the central artery he found a pronounced narrowing of the lumen, from endarteritis proliferans. All the retinal arteries showed arterio-sclerotic changes, ranging from diffuse or crescent-shaped thickenings of the intima, composed of more or less cellular fibrous tissue, to almost complete obliteration of the lumen, from the proliferated tissue. Some branches had been transformed into fibrous cords.

The veins in part were normal, and in part were thickened with sclerosis. They had thrown out new twigs, which were found to terminate in groups of nuclei.

Since the time of von Graefe's report, we know definitely the clinical picture of embolism, but, as is well known, there are other affections which may simulate this clinical picture. According to REIMAR (785) in such cases one must determine whether the blood current has been actually stopped. He believes that as long as the blood column appears to be unbroken, even though thinned from thickening of the vessel wall or obscured by opacity of the vessel wall, and extends to the periphery without a break, circulation still exists; only when the column is broken up and the segments remain still, can one conclude that circulation is completely stopped. With the clinical picture of so-called embolism of the central artery, there are three possible causes of the disturbance in circulation: embolism, thrombosis, and endarteritis proliferans. Reimar states, further, that while the conception of thrombosis or of embolism will allow one to explain many of the symptoms observed, it will not allow one to explain them all; the conception of an endarteritis proliferans of the central artery or its branches, however, fills all the requirements, and this diagnosis is to be made when thickening of the arterial walls can be observed with the ophthalmoscope. In true embolism or thrombosis, which of course occur, we must have complete blindness and granular breaking up of the blood column beyond the obstruction.

LEVIN'S (786) patient was a girl of eighteen who had always seen poorly with her left eye. She had H. 7 D, and the retinal veins and arteries were very tortuous. They ran in corkscrew curves quite to the periphery of the fundus, giving off branches that looped and turned backward. The ophthalmoscopic picture was shown on a lithographic plate. The author regarded the condition as being a congenital anomaly, and this view is strengthened by the existence of hyperopia of 7 D.

FISCHER (787), also, justly objects to the "jubilation that appears even in the illustrated family papers" in regard to the operation for myopia of high degree. The reviewer has already expressed the opinion that as valuable as that operation may be in proper cases, so disastrous are the results of its indiscriminate use. The author discusses in detail post-operative myopia and criticises the papers of Fröhlich and Schröder.

HILBERT (788) has twice observed in his own person a peculiar subjective visual phenomenon not hitherto described. Suddenly and without warning a gleaming yellow zigzag line appeared in the left half of the visual field, having the form of a square open to the right. These lines were seen binocularly, and were purely a hemianopic manifestation; they remained fixed and did not scintillate. The phenomenon is evidently related to scotoma scintillans and to hemicrania.

The interesting features in the case reported by DE SCHWEINITZ (789) are the appearance of what seemed to be amblyopia with marked yellow chromatopsies, central color blindness for red and green, with a total central scotoma in the right eye, due it was thought to the poison of tobacco acting on a system run down by gastro-intestinal catarrh. In the left eye there was apparently a profound amblyopia existing, in the patient's opinion, for many years which was proved to be clearly of hysterical origin. The simulation test revealed vision in that eye as good as in the other. Under abstinence from tobacco the right eye recovered completely in the course of about three months. BURNETT.

It seems from the report given by ERWIN (790) of his cases of two sisters simultaneously affected with the symptoms of snow blindness, that they were not able to distinguish colors. It is unfortunate that a more accurate and scientific examination of the cases was not made. There were the usual symptoms of snow blindness: photophobia, blepharospasm, and diminished visual acuteness. The fundi are reported as being normal. There was restriction of the visual fields. Recovery of color vision followed the disappearance of the other symptoms. BURNETT.

WOODS (791) gives the history in great detail of six cases of amblyopia following the use of Jamaica ginger in intoxicating doses. Four of these cases are from his own practice. While there is some variation in the individual cases as to special symptoms, there can be no doubt that the pathological change is a retrobulbar neuritis of the acute variety—and that alcohol is not the sole cause. There is always contraction of the visual fields, and usually a scotoma as well. The disks, sometimes normal-looking during the first days of the attack, always become white later. BURNETT.

The plan suggested by FRIDENBERG (792) for the detection of simulated monocular blindness, is to hold a small test card in front of the eyes of the subject, with its back to the subject, and

deflect the letters, by means of a large laryngoscopic mirror, into the subject's eyes. By proper management this enlarged vertual image of the letters can be made to fall, at the will of the experimenter, on either retina separately, without the knowledge of the subject, so that it is not possible for him to tell with which eye the letters are seen, though the observer knows. BURNETT.

In the case reported by WÜRDEMANN and MURRAY (793) a man was blinded by a "short circuit" on a dynamo switch. The temporary blindness lasted about two minutes, followed by red after-images. Work was resumed in a short time, but pain in the eyes accompanied with congestion followed in the course of a few hours. The macular region was hazy and the inferior retinal veins congested; V F. contracted. In something over two weeks vision had returned to normal. BURNETT.

The patient whose history is given by VEASEY (794) was a boy of twelve years who suffered from otitis, with mastoid and sinus suppuration. The chief points of interest to the ophthalmologist are: (1) The early beginning of the neuritis after the appearance of the cerebral symptoms and the greater intensity on the side opposite to the lesion. (2) The progressiveness of the neuritis after the operation, the inflammation reaching its acme a week afterwards. (3) Early in the disease the scotomata were absolute, central in one eye, annular in the other. Later the central became larger, and remained absolute, while the annular became relative, but also increased in size.

BURNETT.

WOOD (195) gives in this paper the histories of seven cases of ocular manifestation of hysteria. Some of the conclusions he draws from a study of these cases are the following: Some symptoms, such as reversal of the color fields, the tonic form of blepharospasm, spasm of accommodation and convergence, and pseudoparalytic ptosis, may be regarded as pathognomonic of hysteria. Defects of vision are, generally speaking (with otherwise normal condition of the eye structure), hysterical if accompanied by photophobia and any form of blepharospasm. Hysterical eye troubles are common in men and children.

BURNETT.

RYERSON (796) reports two cases of eye affection after lightning stroke. In one, a girl of twenty-five years, a cataract formed in the course of a few days in both eyes. After needling vision was excellent. In the other case blinding was instantaneous—

dilatation of both pupils; intense congestion of lids, conjunctiva and sclera. No excoriation of the parts, no considerable pain. Optic nerve and retina appeared hazy and the retinal veins were engorged. In eight weeks she was well again, with normal vision. BURNETT.

XX.—OPTIC NERVE.

797. SCHNAUDIGEL. A case of multiple hemorrhages of the organ of vision, and particularly in the sheaths of the optic nerve. *Graefe's Archiv*, xlvii., p. 490.

798. ELSCHNIG. On the anatomy of the optic-nerve atrophy in diseases of the central nervous system. *Wiener Klin. Wochenschr.*, 1899, No. 11.

799. HEINE. Contributions to the anatomy of the myopic eye (optic disc, etc.). *Arch. f. Augenheilk.*, xxxviii., p. 277.

800. ELLINGER. Myxosarcoma of the optic nerve removed by Krönlein's method with preservation of the eyeball. *Zeitschr. f. Augenheilk.*, i., Jan., 1899.

801. VARESE. On the papillitis of disseminate sclerosis. *Arch. di Ottalm.*, v., p. 240.

SCHNAUDIGEL'S (797) patient suffered from epileptic attacks, had fallen on the pavements several times, and finally was brought to an insane asylum in a somnolent condition. Hemorrhages were found beneath the skin of the lids and beneath the conjunctiva. On the left side the disc was reddened and swollen, the arteries normal, and the veins contracted. Along the vessels were many linear hemorrhages. The patient died and an autopsy was made. Both optic nerves were of normal calibre where they passed through the optic canals, but anterior to this they were larger, and near the ball they had the characteristic ampulla shape. Microscopically, hemorrhages were found in the nerve trunk and beneath the dural sheath. The ampulla-like swelling of the nerve was due in part to extravasation of blood, but chiefly to a collection of serous, sanguinolent liquid.

ELSCHNIG (798) examined two cases of partial atrophy of the optic nerve with disseminate sclerosis, using chiefly the Marchi method and counterstaining with thionin. Throughout the nerve, but in varying degree, was an acute inflammation of the interstitial connective tissue. In places there was scarcely any inflammation and here the nerve fibres were normal. In other places

there was fresh inflammation, and here the medullary sheaths of the nerve fibres were breaking down and fatty granular cells were found. In other places still, there was interstitial hypertrophy of long standing, and here the products of nerve-fibre degeneration had disappeared.

The optic-nerve atrophy in disseminate sclerosis is, therefore, a peculiar acute interstitial inflammation which secondarily leads to destruction of the nerve fibres. The neuritis begins at different distinct points and at different times, standing in no relation to the anatomical or physiological relations of the nerve fibres.

Since the primary inflammatory nature of the sclerotic foci in brain and cord is beginning to be more generally believed in, it may be said that the optic-nerve atrophy is a process identical with the general disease.

The tumors of the optic nerve (800) are in the majority of cases benign, and therefore in operating upon them an effort should be made to preserve the eyeball. After Knapp, Schiess, and others had removed the tumor from before with preservation of the ball, Braunschweig introduced into ophthalmology Krönlein's operation of temporary resection of the outer orbital wall. ELLINGER proceeded in accordance with Braunschweig's directions in a suitable case. The patient was a girl of ten, whose left eye had been protruded and displaced outward for two years. Recently the exophthalmus had increased, and iodide of potassium proving of no avail, the operation was resorted to. The egg-shaped tumor was enclosed in a capsule. The optic nerve passed through the growth which proved to be a myxosarcoma.

XXI.—INJURIES, FOREIGN BODIES, AND PARASITES.

802. AXENFELD. On luxation, destruction, and enucleation of the eyes as a form of self-mutilation in the insane. *Zeitschr. f. Augenheilk.*, 1, Feb. 1899.

803. EVERSBUSCH. An anatomically interesting case of unilateral traumatic thrombosis of the retinal veins combined with hemorrhage in the central canal of the vitreous. *Klin. Monatsbl. f. Augenheilk.*, 1899, p. 1.

804. MEYER. Ruptures of the choroid and retina from a revolver shot. "Mémoires originaux," *Révue générale d'opht.*, 1899, p. 1.

805. OSTWALT. Traumatic injury of the aortic valve followed by embolism of the central artery of the retina. *Rec. d'opht.*, 1899, p. 65.

806. FISCHER. Enophthalmus traumaticus. Atrophy of the corresponding half of the face. *Centralbl. f. Augenheilk.*, xxiii., 1899.

To the nine reported cases of self-mutilation of the eyes by the insane AXENFELD (802) adds five new cases. In these the fingers were forced into the orbit and acting like a lever with the margin of the orbit for a fulcrum the eyes were pryed out. Experiments on dead bodies proved that this was possible.

EVERSBUSCH'S (803) patient was a stone cutter of sixteen, who fell on a shovel and fractured the right superior maxilla and lost the vision of the left eye. In the vitreous was a delicate grayish-blue disc from which six divergent and slightly wrinkled grayish filaments extended forward. From the margins of the grayish disc many regularly arranged processes extended out surrounding the middle portion of the vitreous. These peculiar formations were regarded as connective-tissue remains of a hemorrhage that had radiated outward into the periphery of the vitreous through the preformed lymph spaces of the vitreous.

FISCHER'S (806) patient was a man of thirty, who fell four weeks before and struck on the upper margin of the orbit. The eye is now sunken several millimetres so that the upper lid shows a deep furrow. The optic nerve is healthy. The superior rectus is paralyzed. The adipose tissue of the entire right cheek is atrophied and the superior maxilla is depressed although no fracture can be made out.

XXII.—OCULAR DISTURBANCES IN GENERAL DISEASES.

807. BÄCK. On leucæmic changes in the eyes. *Zeitschr. f. Augenheilk.*, 1899, No. 3.

808. WINGENROTH. Contributions to the treatment of acute inflammation of the optic nerve in consequence of influenza. *Klin. Monatsbl. f. Augenheilk.*, xxxvii., p. 85.

809. LAGLEYZE. The eye and the teeth. Pathological relations. *Arch. d'opht.*, xix., No. 3, p. 146.

810. TERRIEN. Metastatic ophthalmia followed by death. Anatomical examination. Propagation of the optic neuritis from the diseased eye to the optic nerve of the healthy eye through the chiasm. *Ibid.*, p. 170.

811. GRÒSZ. Amaurosis from acquired chronic internal hydrocephalus; puncture of the lateral ventricle; recovery. *Ung. med. Presse*, 1899. No. 13.

812. DEJESINE and LONG. On the localization of the lesion in hemianæsthesia from an affection of the capsule. *Soc. de biologie*, Dec. 24, 1898; *Ann. d'ocul.*, cxxi., p. 123.

813. DE WECKER. The danger of specific treatment in tabic atrophy of the optic nerves. *Ann. d'ocul.*, cxxi., p. 16.

814. KUHNT. On acute intoxication from methyl alcohol. *Zeitschr. f. Augenheilk.*, i., Jan., 1899.

815. STRZEMINSKI. Three cases of hereditary retrobulbar neuritis in one family. *Ann. d'ocul.*, cxxi., p. 99.

816. DREYER-DUFER. A circular form of syphilitic chorioretinitis. *Ibid.*, p. 118.

Retinitis leucæmia has long been the subject of pathological study, but the ideas as to the underlying cause have been very divergent. BÄCK (807) describes two cases. The first was in a woman of very anæmic appearance. The optic discs were reddish-yellow, elevated, and blurred at the margins. The veins were tortuous and as pale as the arteries. In the periphery were found grayish patches with hemorrhagic foci. The blood showed the usual cellular changes of leucæmia. Under the microscope the episcleral tissue was found to be infiltrated with leucocytes. The nerve head was swollen from the enormously dilated blood-vessels, and about the disc were flat accumulations of leucocytes which were found also in the periphery of the retina. The choroid had five times its normal thickness.

The second case was in a girl of twelve, and was similar. The essence of the changes consists in the increase of the leucocytes present. The new formations consist chiefly of extravasated leucocytes.

WINGENROTH (808) described three cases of pronounced papilloretinitis following influenza. In the first case there was a large central scotoma, in the second contraction of the visual field, and in the third a negative central scotoma. Mecurials and diaphoretics caused considerable improvement.

After a short review of the anatomical relations between the eyes and teeth, and the diseases of the latter, LAGLEYZE (809) in the portion of his paper that has already appeared, takes up the various affections of the eye which may be caused by diseases of

the teeth, and are usually described as arising reflexly. He differentiates, 1, vegetative disturbances such as lachrymation, blepharitis, conjunctivitis, keratitis, and glaucoma; 2, motor disturbances such as spasm and paralysis of the muscles; and 3, nervous disturbances such as neuralgia, photophobia, amblyopia, and amaurosis. v. MITTELSTÄDT.

TERRIEN's (810) patient was a seamstress of thirty-nine with leucorrhœa. A streptococcus infection arising from a small polyp of the uterus led to inflammation of the right knee-joint and on the following day to a right ophthalmia. After her death, seventeen days later, it was not possible to say whether the choroid or the retina had been first involved. Besides the ocular changes there was a degeneration of the myeline sheaths of the optic-nerve fibres which could be followed up through the chiasm and tracts. v. MITTELSTÄDT.

In a case of acquired chronic internal hydrocephalus GRÒSZ (811) was able by repeated puncture of the lateral ventricle to cure the blindness which existed. Improvement was noticed even after the first puncture, and the infant of ten months was able to see again, although only 40 *ccm* of liquid was evacuated. Three days later the vision became worse, and a second puncture was made. Seventy *ccm* of liquid was then evacuated, when the infant showed signs of collapse. The effect, however, was permanent. In this case the puncture was made through the fontanelle. In cases in which the fontanelles are closed trephining is necessary. HERRNHEISER.

In the so-called capsular hemianæsthesia (812) the visual disturbance consists in a diminution of central vision with contraction of the field of vision of each eye toward the anæsthetic and hemiplegic side. The most typical cases are those seen in hysterical subjects, although organic hemianæsthesia may be accompanied by a homonymous hemianopsia. In all cases of hemianæsthesia with hemianopsia there is an interruption of the greater portion of the bundle of fibres that runs from the optic thalamus to the cerebral cortex. Details are given as to the exact location of the lesion in three cases examined. SULZER.

BOOK NOTICES.

(*Continued from page* 483.)

XXIX. **Die Verletzungen des Auges.** Ein Handbuch für den Praktiker, by Dr. E. PRAUN, oculist at Darmstadt. 8vo, pp. 530. Wiesbaden, J. F. Bergmann, 1899.

In this book, which bears evidence of enormous literary research, the author treats of every possible injury to the eye and its appendages, and of every possible complication and result of these injuries, including such matters as wound infection and sympathetic ophthalmia. In large type, in a practical way, he gives a detailed description of each traumatic condition, with its course, diagnosis, and therapy; while in smaller type are introduced theoretical discussions, pathological descriptions, and histories of instructive cases from his own large practice in this field and from the literature.

The literary references seem to be very complete indeed; and, with its systematic arrangement, its table of contents, and its good subject and author indexes, the book forms a valuable work of reference which distinctly fills a gap in ophthalmological literature. W. A. H.

XXX. **Beitrag zur Casuistik des Exophthalmus pulsans.** By Dr. EMIL KELLER. Inaugural dissertation. Small 8vo, pp. 208. Art. Institut Orell Füssli. Zurich, 1898.

The author in this dissertation reports two cases of pulsating exophthalmus observed in the Zurich clinic, and taking up the literature where Sattler left it off in his article in *Graefe-Sæmisch*, he adds in tabular form the histories of one hundred and two cases reported since 1880, and concludes with a consideration of the clinical course, pathology, and treatment of this condition.

W. A. H.

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